CleanAir Workshops series 023

Dust Monitoring Compliance

Thursday, September 14, 2023

Morning Program

9:00 Welcome

9:05 Overview and Updates of CDPH Regulatory and Community Air Monitoring Approaches
Michael Enos, CDPH

9:40 Regional and National Regulatory Overview
Brian Newgent and Claire Amin, Aeroqual

10:05 Monitoring Program Design and Data Analysis Considerations
Volker Schmid, CleanAir

10:30 **BREAK**

10:45 Intro to Site Contribution Analysis and Aeroqual's Site Contribution Tool
Connor Porter, Aeroqual

11:10 New Developments for Special Applications
Don Allen and Volker Schmid, CleanAir

11:35 Top 10 Support Questions
Don Allen, CleanAir, and Connor Porter, Aeroqual

12:00 **LUNCH**

aeroqual

CleanAir

CleanAir Workshops

Dust Monitoring Compliance

cleanair.com/workshops/dust

Regional and National Regulatory Overview

Air & Dust Monitoring Solutions for Environmental Professionals – ***"Air Monitoring Made Easy!"***

aeroqual

Protecting people and planet from the harmful effects of air pollution starts with reliable and actionable air quality data.

- Founded in 2001, we pioneered the use of sensors for monitoring the quality of ambient air
  - Coined the term “Near-Reference”
- Today we are the leading air quality monitoring platform
  - Integrated instrumentation and software
  - 6 sensor technology patents
  - 10M+ air monitoring measurements daily
  - 100+ regional partners globally
  - U.S. EPA R&D collaboration agreement

CleanAir®

CleanAir Workshops

Dust Monitoring Compliance

cleanair.com/workshops/dust

The U.S. EPA announced a 5-year Cooperative Research and Development Agreement (CRADA) with Aeroqual.

"EPA is looking forward to collaborating with Aeroqual to improve knowledge of air sensor technologies, explore applications, and better understand the challenges of these devices such as calibration and performance over long time periods."

— Dr. Rachelle Duvall of U.S. EPA's Office of Research and Development

EPA Combines Expertise with New Zealand Company to Advance Air Sensor Technologies | US EPA

Our Credentials

U.S. EPA Collaboration

Aeroqual has a five-year Cooperative Research and Development Agreement (CRADA) with the U.S. EPA to advance air sensor technologies

ASTM International

Member of ASTM International Air Quality Committee (D22) developing new standard WK64899 for air quality sensors installed in cities, communities, and industrial sites.

MET ONE inside

Met One proven particle sensing technology has been integrated inside our products since 2009. Met One technology is used by 85% of U.S. environmental agencies.

MCERTS certification

World's first nephelometer to meet the UK Environmental Agency's MCERTS indicative particle monitoring standard. This drives pre-approval for use in US and global regulations.

Rule 1466 pre-approved

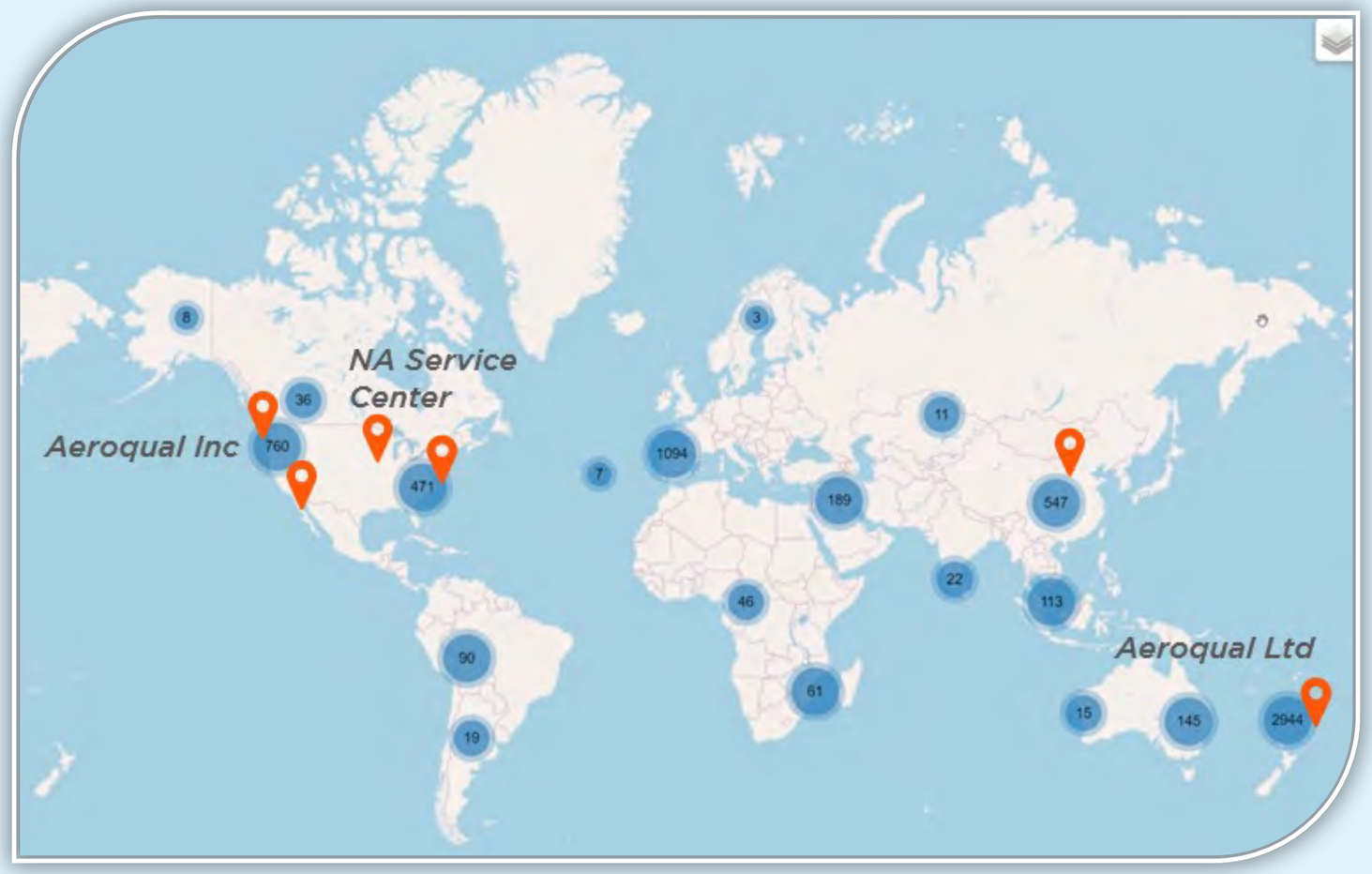
Aeroqual Dust Sentry is pre-approved by Executive Officer for SCAQMD for compliance monitoring under Rule 1466 and Rule 403 in California.

ISO 9001:2015 Certified

We operate a quality management system accredited to ISO 9001:2015 which requires stringent process adherence and speaks to the high level of QA/QC.

Aeroqual Connected Air Monitors

Two-way Integration | Cloud Storage | Real-Time Data and Alerts

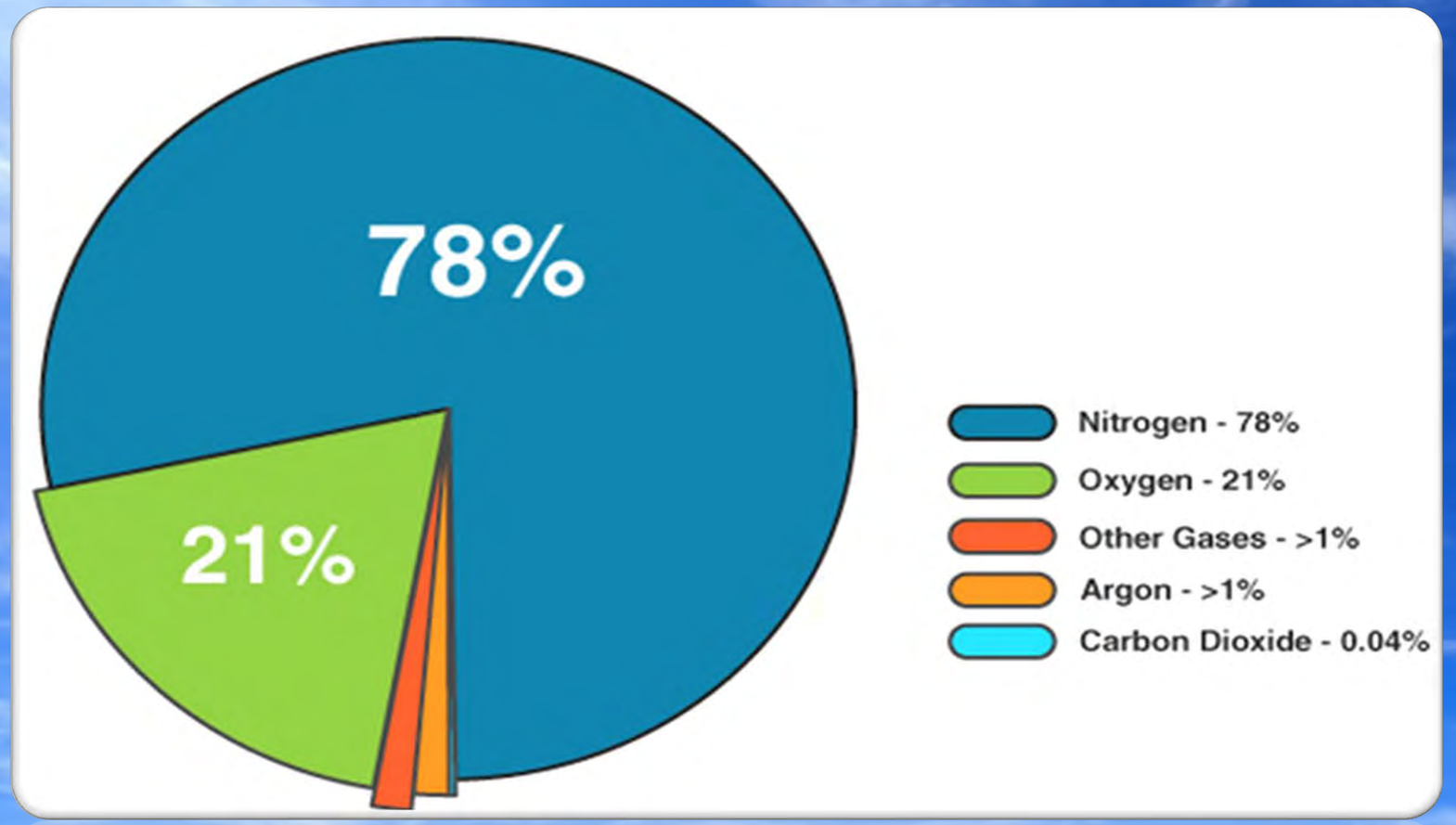


- 6,582 Global
- 100 Regional Partners

- 7M+ datapoints /day
- 99% Data Uptime

"We Make it Easier to Monitor Air Quality"

What is the basic composition of “Air”?



1963 Clean Air Act – Hazardous Air Pollutants

"Toxic pollutants that are known or suspected to cause cancer or other serious health effects"

There are about 187 hazardous air pollutants (HAPs) that EPA is required to control.

List of 30 Urban Air Toxics		
Acetaldehyde	Dioxin	Mercury compounds
Acrolein	Propylene dichloride	Methylene chloride (dichloromethane)
Acrylonitrile	1,3-dichloropropene	Nickel compounds
Arsenic compounds	Ethylene dichloride (1,2-dichloroethane)	Polychlorinated biphenyls (PCBs)
Benzene	Ethylene oxide	Polycyclic organic matter (POM)
Beryllium compounds	Formaldehyde	Quinoline
1,3-butadiene	Hexachlorobenzene	1,1,2,2-tetrachloroethane
Cadmium compounds	Hydrazine	Tetrachloroethylene (perchloroethylene)
Chloroform	Lead compounds	Trichloroethylene
Chromium compounds	Manganese compounds	Vinyl chloride

Urban Air Toxic Pollutants | US EPA

Pittsburgh at the junction of the Monongahela and Allegheny rivers in 1936 (left), and in 2014 (right) (Left photo © Margaret Bourke-White/The LIFE Picture Collection/Getty Images. Right photo © Clarence Holmes Photography/Alamy)

Pittsburgh 1936 vs. 2014

1970 EPA Establishes Criteria Pollutants

Criteria Air Pollutants can be harmful to public health and the environment

The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants (also known as "criteria air pollutants")

National Ambient Air Quality Standards

Criteria Air Pollutants can be harmful to public health and the environment

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

- Primary Standards provide health protection, including sensitive populations – asthmatics, children, and the elderly
- Secondary Standards provide public welfare protection (decreased visibility and damage to animals, crops, vegetation, and buildings

- EPA must designate areas as meeting (attainment) or not meeting (nonattainment) the standard.
- The Clean Air Act requires states to develop a general plan to attain and maintain the standards in all areas of the country and a specific plan to attain the standards for each area designated nonattainment.
  - These plans, known as State Implementation Plans or SIPs, are developed by state and local air quality management agencies and submitted to EPA for approval.

Recent or Proposed Changes (EPA)

Community Air Monitoring
June 25, 2021

Methane
November 11, 2022

PM2.5 Standard
January 6, 2023

Ethylene Oxide
April 11, 2023

Ozone
August 21, 2023

ARP American Rescue Plan - Enhanced Air Quality Monitoring for Communities

- ❑ June 25, 2021 -ARP American Rescue Plan - Enhanced Air Quality Monitoring for Communities
- ❑ Replace existing filter-based PM2.5 monitors or enhance existing to provide 24/7, real-time reporting
- ❑ Automation of PM2.5 Monitors
- ❑ Enhanced monitoring of PM2.5 and five other air pollutants regulated by the National Ambient Air Quality Standards under the Clean Air Act
- ❑ Conduct monitoring of pollutants of greatest concern
- ❑ For Agency mobile monitoring labs or Air Sensor Loan Programs. (Short-term monitoring and air quality information)

Biden-Harris Administration Strengthens Proposal to Cut Methane Pollution to Protect Communities, Combat Climate Change, and Bolster American Innovation | US EPA

EPA Proposal to Reduce Methane

- November 11, 2022 - The U.S. Environmental Protection Agency (EPA) announced it is strengthening its proposed standards to cut **Methane** and other harmful air pollution.
- The agency estimates that in 2030, the proposal would reduce methane from “Super Emitter” sources by 87 percent below 2005 levels.
- EPA projects that the proposed standards would reduce an estimated 36 million tons of methane emissions from 2023 to 2035, the equivalent of 810 million metric tons of carbon dioxide.

Biden-Harris Administration Strengthens Proposal to Cut Methane Pollution to Protect Communities, Combat Climate Change, and Bolster American Innovation | US EPA

EPA Proposed Changes to PM2.5 Standard

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January 6, 2023 - EPA announced its proposed decision to revise the primary (health-based) annual **PM2.5 standard** from its current level of 12.0 µg/m3 to within the range of 9.0 to 10.0 µg/m3

EPA Proposes to Strengthen Air Quality Standards to Protect the Public from Harmful Effects of Soot | US EPA

EPA Proposal to Reduce Ethylene Oxide

- April 11, 2023, EPA proposed new requirements for 86 commercial sterilizers across the country.
- These requirements, if implemented, will reduce the amount of **Ethylene Oxide** Emissions EtO that comes out of commercial sterilizers by 80 percent

Proposal to Reduce Ethylene Oxide Emissions from Commercial Sterilization Facilities | US EPA

EPA announced a new review of the Ozone National Ambient Air Quality Standards (NAAQS)

- August 21, 2023 EPA announced a new review of the Ozone National Ambient Air Quality Standards (NAAQS) to ensure the standards reflect the most current, relevant science and protect people's health from these harmful pollutants

EPA Initiates New Review of the Ozone National Ambient Air Quality Standards to Reflect the Latest Science | US EPA

Regional Regulations

- **May 3, 2010 - New York State Department of Environmental Conservation (DEC) remedial programs Issues**
  - DER-10, Technical Guidance for Site Investigation and Remediation - administered by the Division of Environmental Remediation (DER) – (New Rules coming soon)
  - VOC action levels > 5ppm and >25 ppm above background
  - PM10 action levels >100 Ug/M3 above Upwind (15min Avg), >150 Ug/M3 above Upwind (15min Avg)
- **April 19, 2021 - Chicago Department of Public Health – Demolition by Implosion**
  - The Comprehensive Plan must include a comprehensive air monitoring plan that investigates air quality impacts from Fugitive Dust prior to Implosion and a plan for the monitoring of PM 10 in the air before, during, and after Implosion activities using instruments designated as Federal Equivalent Method (FEM) by EPA or meet the requirements for a Near Reference PM 10 Monitor
- **January 1, 2023 - SCAQMD Rule 1466 Amendment**
  - PM10 calculation methodology require calculation of the two-hour PM10 average concentration as a rolling average every minute
  - Clarify that PM10 average calculation restarts when resuming earth-moving activities after addressing a PM10 concentration exceedance
  - Revise wind monitoring requirements
  - Action Levels If the PM10 site activity contribution (downwind minus upwind concentration) exceeds 25 micrograms per cubic meter (µg/m3) averaged over one hour…earth-moving operations cannot recommence until the particulate contribution drops below 25 µg/m3 averaged over 30 minutes.
- **March 7, 2023 – Chicago Department of Public Health - Revises Rules for Reprocessable Construction/Demolition Material Facilities**
  - Chicago’s new rule for waste reprocessing facilities allows the use of near-reference PM10 monitors that are SCAQMD 1466 approved.
  - Reportable Action Level is the PM10 concentrations above 150 micrograms per cubic meter averaged over a 15-minute period.
  - Facilities using FEM monitors may subtract the upwind PM10 concentration from the downwind PM10 concentration in determining a PM10 RAL exceedance.

Methods for Measuring Pollutants

CRITERIA POLLUTANTS

OTHER POLLUTANTS OF CONCERN

Pollutant	EPA Reference Method	EPA Equivalent Method (or Measurement Technology for Non-Criteria Pollutants)	Near Reference (* w/ ABC – Automatic Baseline Correction)
Ozone	UV Photometric Ozone Analyzer	• UV Absorption O3 Analyzer • Chemiluminescence Ozone Analyzers	*AQM LZ (0-500 ppb) GSS (Gas Sensitive Semiconductor)
Sulphur Dioxide	Pararosaniline Method (Manual)	UV Fluorescence SO2 Analyzer	*AQM SOL (0-10000 ppb) GSE (Gas Sensitive Electrochemical)
Carbon Monoxide		Gas Filter Correlation CO Analyzer	*AQM CO (0-25 ppm) GSE (Gas Sensitive Electrochemical)
Nitrogen Dioxide		• Chemiluminescence NO/NO2/NOx Analyzer • CAPS True NO2-NOX-NO Analyzer (Cavity Attenuated Phase Shift Spectroscopy)	*AQM NO2 (0-500 ppb) GSE (Gas Sensitive Electrochemical)
Lead	Physical Sample Collection with Lab Analysis		NA
Particulate Matter	Gravimetric High-Volume	• Broadband spectroscopy ,LED technology w/ well-understood light scattering theory • BAM • TEOM	Dust Sentry, PMX (Nephelometer/Particle Counter)
Carbon Dioxide	Performance Based	Gas Filter Correlation CO2 Analyzer	*AQM CD (0-2000 ppm) NDIR (Non-Dispersive Infra-Red)
Nitrogen Oxides	Performance Based	• Chemiluminescence NO/NO2/NOx Analyzer • CAPS True NO2-NOX-NO Analyzer (Cavity Attenuated Phase Shift Spectroscopy)	*AQM NX (0-0.5 ppm) GSS (Gas Sensitive Semiconductor)
Hydrogen Sulfide	Performance Based	UV Fluorescence H2S Analyzer	*AQM HSL (0-10000 ppb) GSE (Gas Sensitive Electrochemical)
Volatile Organic Compounds (VOC)	Performance Based	Performance Based	*AQM VOC (L/H) (0-500 ppb or 0-30 ppm) PID (Photoionization Detector) GC-PID, GC–FID, GC-MS
Methane	Performance Based	Performance Based	*AQM MT (0-100 ppm) GSS (Gas Sensitive Semiconductor) FID
BTEX (Benzene, Toluene, Ethylbenzene, and Xylene)	Performance Based	Performance Based	AQM BTEX (0.1 – 50 ppb) GC (Carrier Gas Free Miniature Gas Chromatograph) GC PID
Ethylene Oxide	Performance Based	Cavity Ring-Down Spectroscopy	NA

Our Product

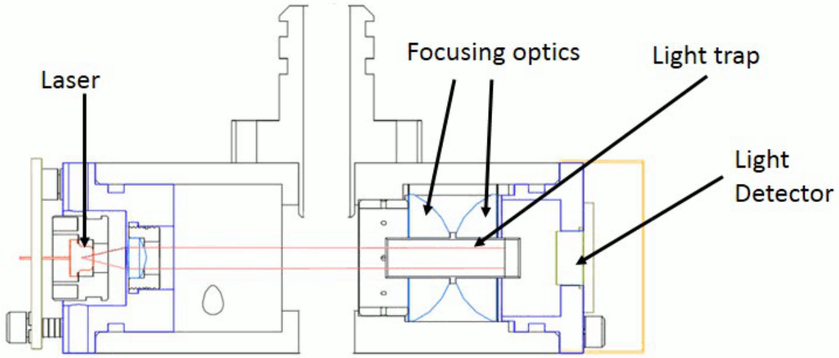
Fully-Integrated Solution

Real-Time, Actionable and Defensible Data

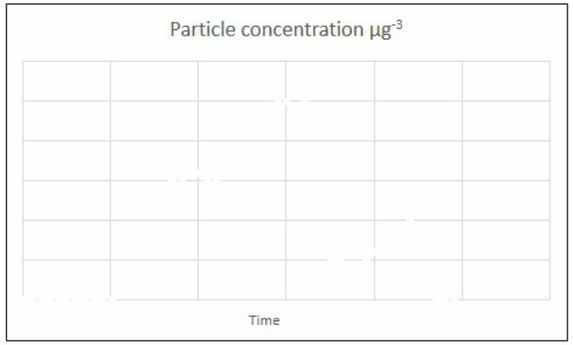
Available sensors: PM10, PM2.5, PM1, TSP, NO2, CO, CO2, O3, SO2, NOx, VOC, H2S, Meteorological, noise + 3rd party

Dust Sentry (Nephelometer)

Under conditions of zero particle load, all of the laser light is caught by the light trap, no light reaches the detector.



When particles fall through the laser beam, light is scattered, the light is focused on to a detector which produces a signal proportional to the amount of particles in the light beam.



- **Replace existing filter-based PM2.5 monitors** or enhance existing **to provide 24/7, real-time reporting of air quality concentrations**

Dust Sentry PCX and Pro

(Particle Counter)

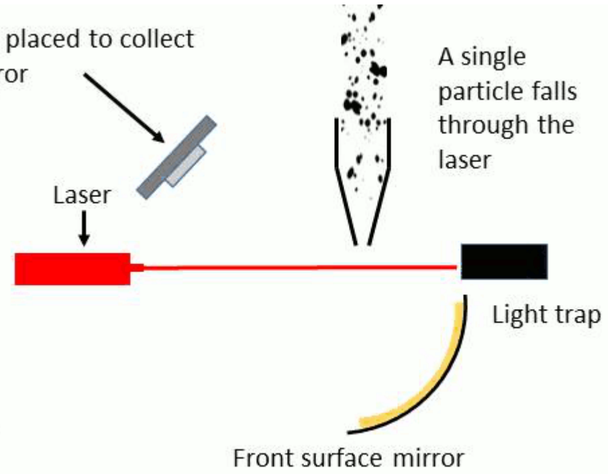
Under conditions of zero particle load, all of the laser light is caught by the light trap, no light reaches the detector.

When a single particle falls through the laser beam, light is scattered, some light is captured by the mirror and then focused upon the detector. The amount of light scattered depends on the particle size.

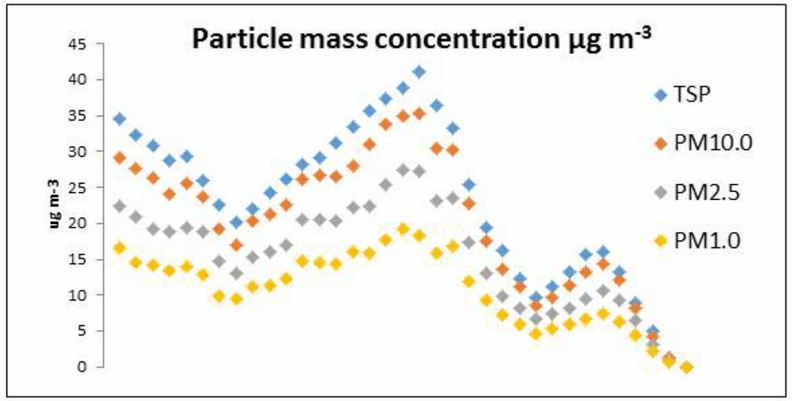
Each particle results in a single pulse which is counted, the height of the pulse is proportional to the size of the particle. The counts accumulate over a fixed sampling time.

After the fixed sampling time, particle counts are mathematically converted in to mass to provide particle concentrations in four sizes: TSP, PM10.0, PM2.5 and PM1.0. The mass measurement is recorded. Then the counts are set to zero and the process is repeated for another measurement cycle.

This results in a time series of four particle size fractions TSP, PM10.0, PM2.5 and PM1.0.



Particle size	Counts
0.3	0
0.5	0
0.7	0
1.0	0
2.0	0
3.0	0
5.0	0
10.0	0
$\int f(x)$	
	↓↓
TSP	0
PM10.0	0
PM2.5	0
PM1.0	0



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Aeroqual Analyzer Modules

Delivering Near-Reference Levels of Performance for AQM/AQS

GSS Our Gas Sensitive Semiconductor sensors use proprietary sensing material, built-in **ABC** (Automatic Baseline Correction) and interference rejection. This combination results in ppb resolution and a highly linear response.

GSE Our Gas Sensitive Electrochemical sensors generate nano-amp currents proportional to the gas concentration. Aeroqual uses low noise electronics to capture these signals resulting in low detection levels.

NDIR Our Non-Dispersive Infra-Red sensors use infra-red light, a narrow band-pass filter and photodiode to measure the intensity of light at the gas absorption band. The light intensity is proportional to the gas concentration.

PID Our Photo Ionization Detector sensors use a krypton filled UV lamp to ionize VOC gas molecules and generate a current that's proportional to the VOC concentration. The PID sensor responds to a wide range of VOCs and is industry recognized.

- Conduct monitoring of pollutants of greatest concern
- Strengthening its proposed standards to cut **Methane** and other harmful air pollution

Aeroqual Ranger

Cloud Connected | Zero Calibration Downtime

28 Sensor Heads Spanning 14 Gases plus PM

PM 1, PM2.5, RES, PM10, TSP

CO | CO_2 | Perc | VOC | CH_4 | O_3 | Cl_2

CH_2O | H_2S | H_2 | NH_3 | NO_2 | SO_2 | NMHC

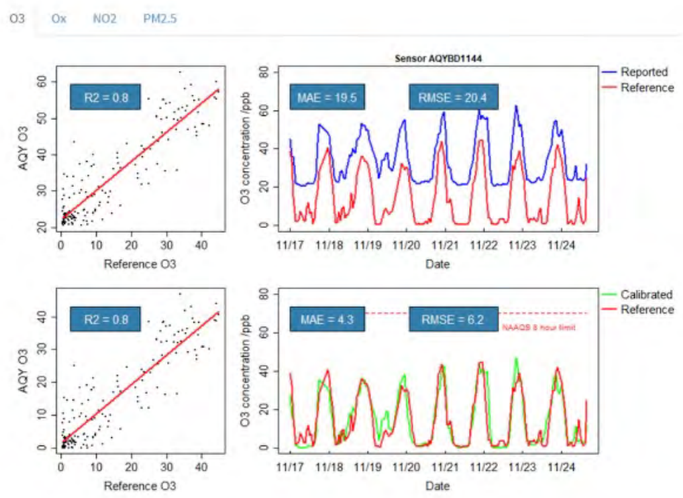
For Agency mobile monitoring labs or Air Sensor Loan Programs.
(Short-term monitoring and air quality information)

Aeroqual MOMA

A complete pollution monitoring software solution for air quality sensor networks

Aeroqual smart monitors or BYOD*

Unify's complete air quality network solution is compatible with one of Aeroqual's connected instruments and a range of third party devices.



Virtual calibration service (MOMA)

Calibrations are run by Aeroqual's air quality systems and data experts using our proprietary MOMA tool.

Reduced travel costs

Cut down on on-site visits, saving time and money.

Reduced labor cost

Remote calibration makes air quality network monitoring easy.

Less data processing

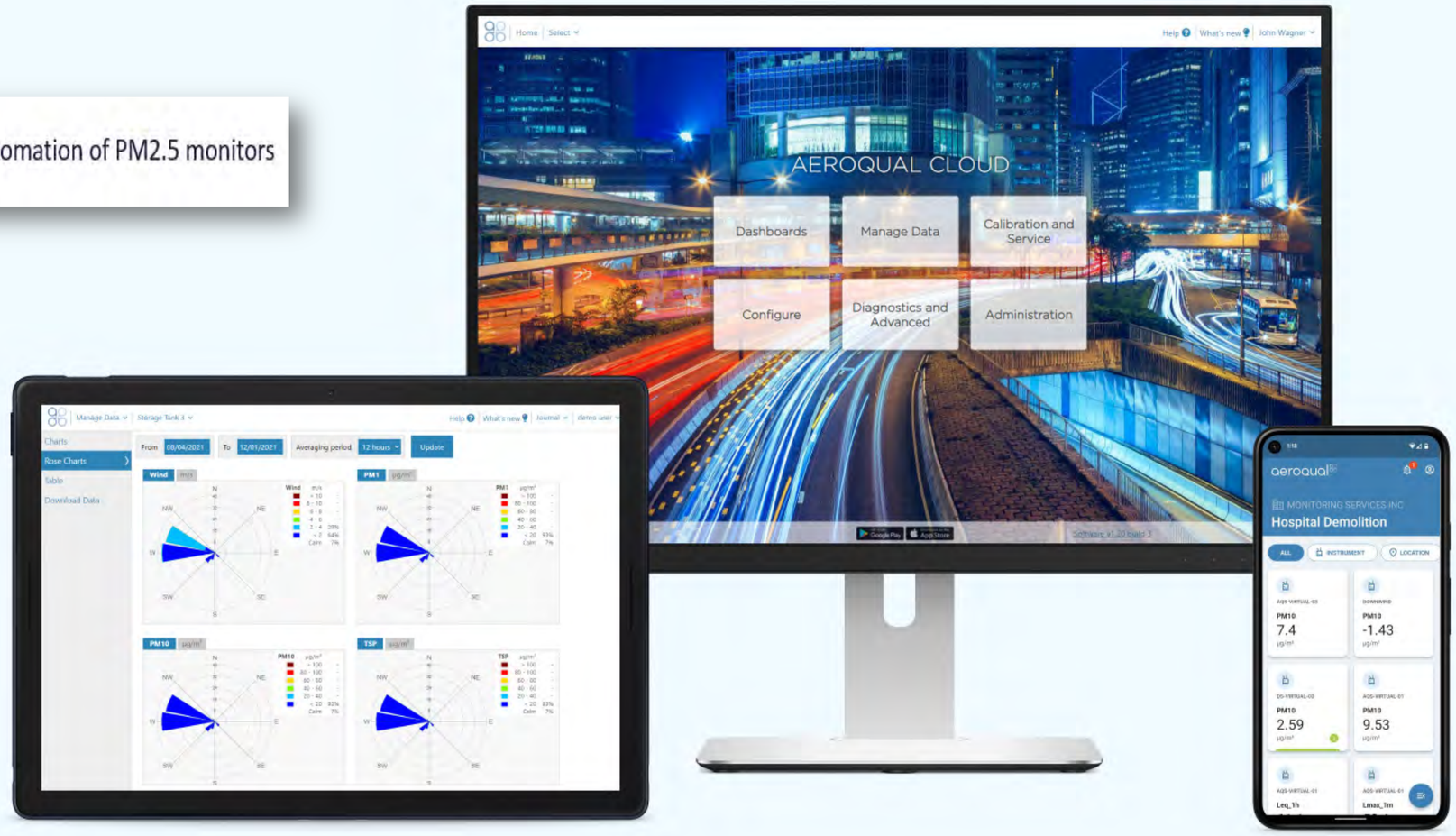
Improve data quality without increasing labor.

- ARP Enhanced Air Quality Monitoring for Communities
- Proposed decision to revise the primary (health-based) annual PM2.5 standard from its current level of 12.0 µg/m3 to within the range of 9.0 to 10.0 µg/m3
- Automation of PM2.5 monitors
- Replace existing filter-based PM2.5 monitors or enhance existing to provide 24/7, real-time reporting of air quality concentrations

Aeroqual Cloud

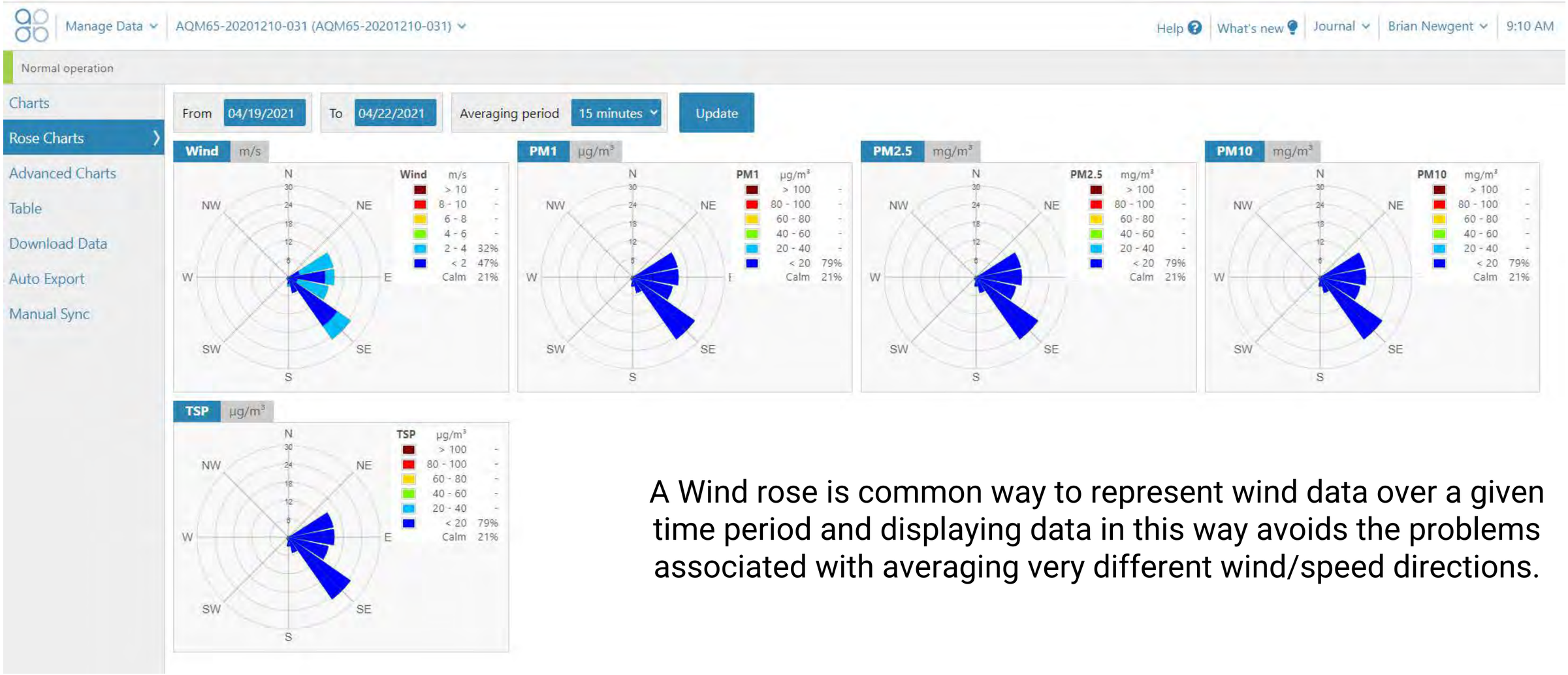
Data Visualization and Software Tools to Maximize Performance and Sharpen Accuracy

Automation of PM2.5 monitors



Data Visualization Tools

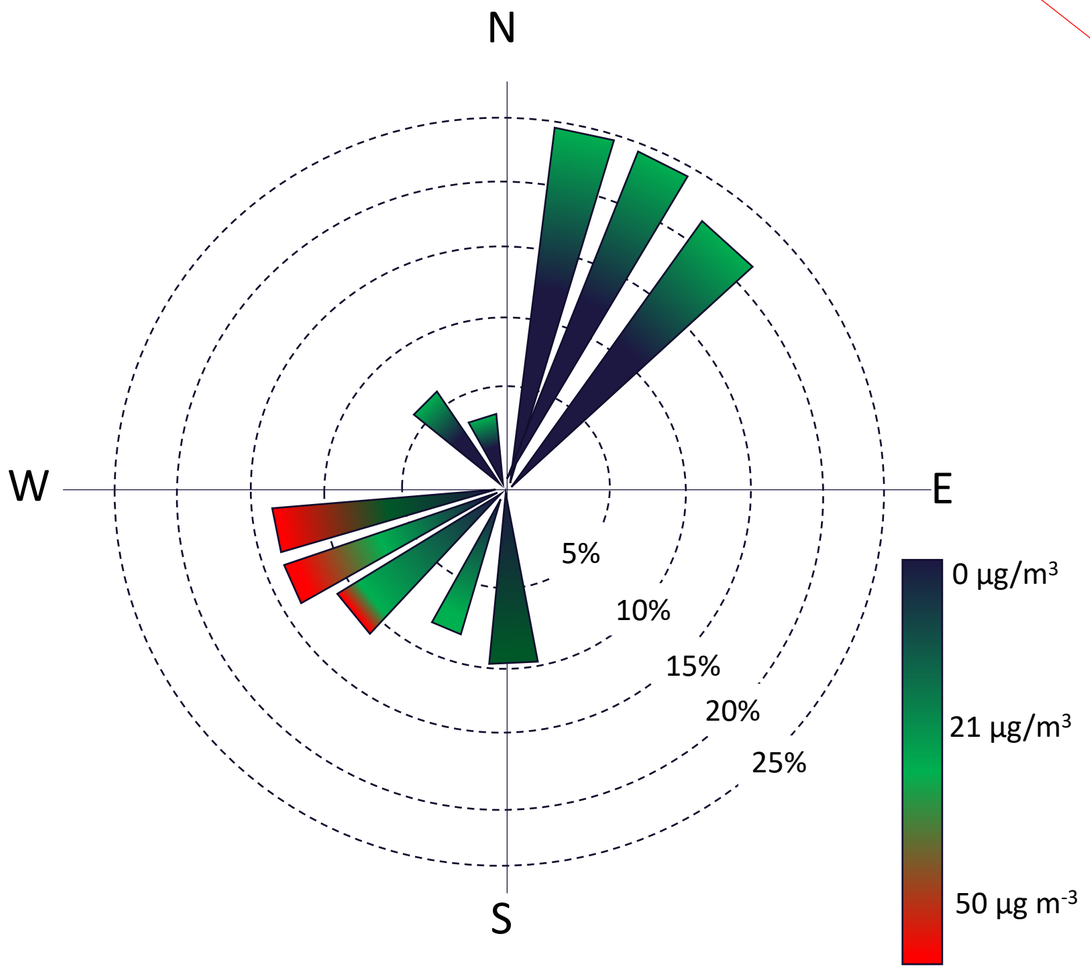
Aeroqual Cloud Pollution Charts



A Wind rose is common way to represent wind data over a given time period and displaying data in this way avoids the problems associated with averaging very different wind/speed directions.

Rose Chart | PM Contribution

Dust Monitor location with additional wind speed/direction sensor, located on the boundary between residential area and power station.



Coal fired power station.

Residential area

The pollution rose says that most of wind comes from the **NorthEast** and when it does **PM values are low**. But when wind blows from the **SouthWest PM values are high.**

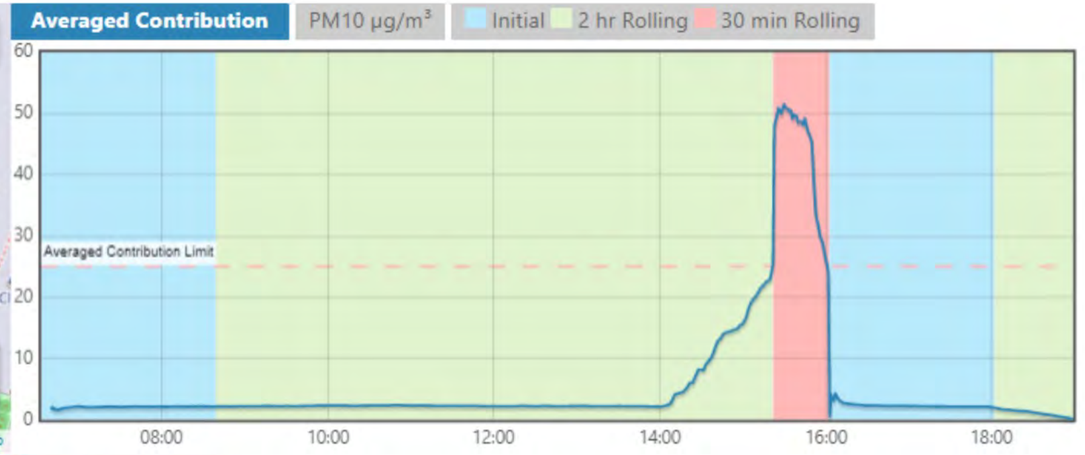
Site Contribution

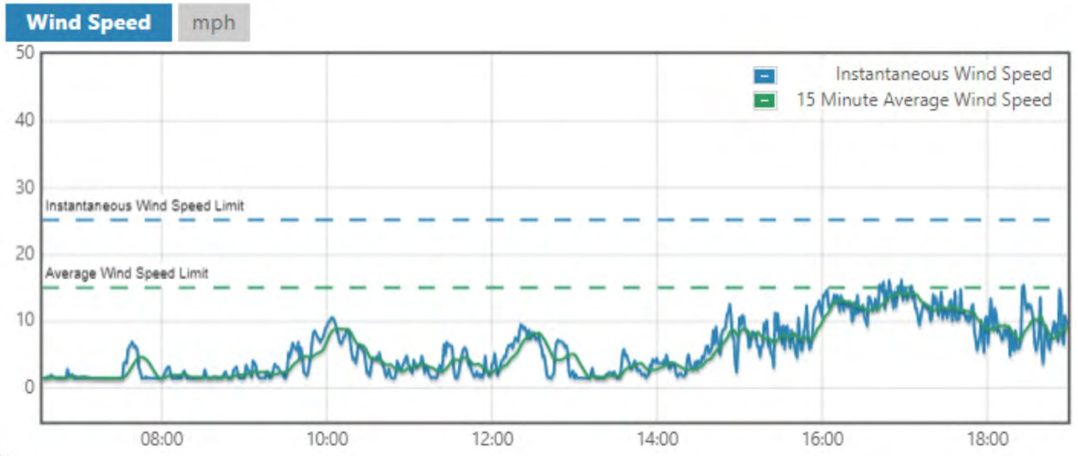
The software automatically tracks pollutant levels, wind direction and speed to calculate the total site contribution. Real-time alerts notify you within a minute if you are approaching regulatory limits. **It seamlessly reports data in the required format.**

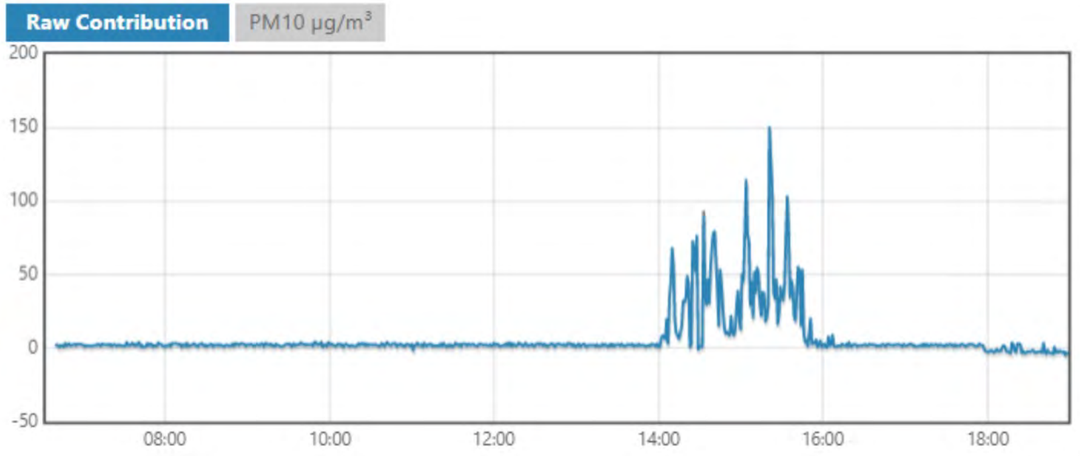
Site Contribution - Dusty Remediation - Historical View

From Date 04/02/2022 06:00 To Date 04/02/2022 19:00 Update

Export as JSON Export as CSV Live View







Data Outcome...

Questions...