



Wayne Hose

Queensland - Australia
20 + Years Mining Equipment & Technology
National Roles : P&H MinePro, Joy Global,
Komatsu

Global BDM Pinssar



Continuous DPM Monitoring Is a Game Changer



Everyone deserves to be SAFE and HEALTHY at work



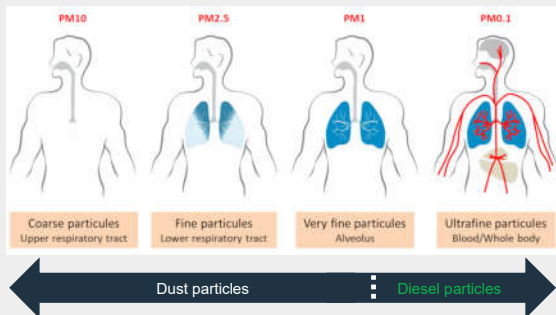
Diesel emissions can be **SAFELY** managed.

As society moves toward a future with more and more data available at its fingertips, traditional industries such as construction and mining are drawing on new technologies to enable real-time decision making to deliver g  ertainty.

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DPM Health Threat

In 2012 The World Health Organization declared diesel engine exhaust emissions a **Group1 Carcinogen** - The highest risk category and the same category as asbestos

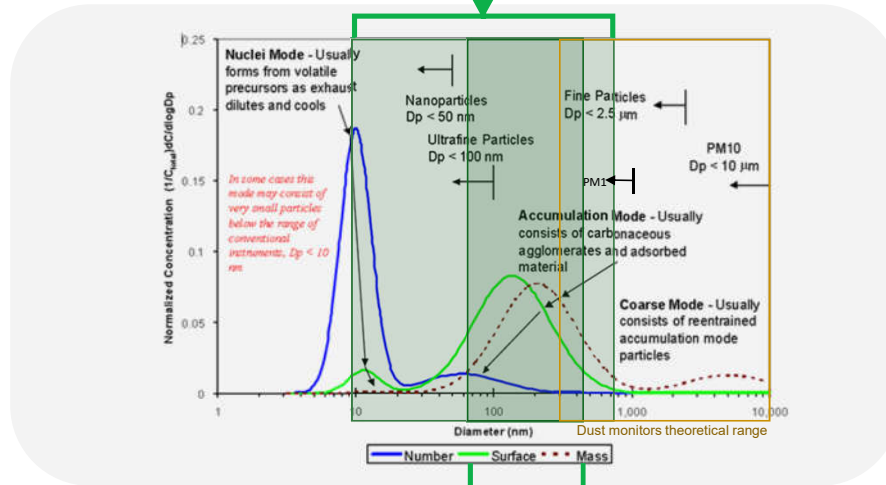


- Diesel Particulate Matter (DPM) is sub PM1 (1 Micron) (1000 nanometres) and much smaller
- Diesel Particulate smaller than 1 Micron can be readily absorbed into the bloodstream via the alveoli in the lungs
- DPM once absorbed, adversely affects the lungs, heart and the brain and can cause cancer

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Specifically Monitoring the Diesel Emissions Range



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Peak Accuracy In The Critical 70 - 370nm Agglomerated Zone



Monitoring Methods for diesel emissions.

> **TAILPIPE TESTING** (regulatory via MDG29)

> **PERSONAL MONITORING** Gravimetric measurement (regulatory via NIOSH 5040)

> **AMBIENT AIR - hand held** DPM Monitoring (random checks to verify ventilation)

You can't manage your controls without 24/7 monitoring

> **AMBIENT AIR - fixed** Continuous Realtime DPM monitoring (verify controls)



- > Random
- > Intermittent
- > Spot checks
- > Point in time validation

- > Continuous
- > Real-time
- > Communicating positive health messages
- > Ongoing validation
- > Verification of mitigating controls

DIESEL PARTICULATE MATTER MANAGEMENT COMMITTEE (SITE AND GROUP BASED)



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Two Part Solution

Real-time DPM monitoring systems are now **ultra low maintenance, robust, real time, continuous particulate monitoring systems** – specifically designed for long-term deployment in aggressive environments contaminated by diesel particulate matter.

Designed to provide **practical - usable – configurable data to assist in managing DPM levels as well as time weighted shift averages and trends in real-time** to validate your controls to protect your people and your production/project progress.



CONNECTIVITY = Data Driven Decisions



MANAGE CONTINUOUSLY





CASE STUDY – Western Australia Gold Mine

The Challenge

- 1 > Monitoring was proposed to be undertaken to establish a baseline with a world first continuous real-time fixed monitor being the most practical and safest long-term methodology to monitor a group 1 carcinogenic.
- 2 > The Reader was installed in late 2017 and kept insitu for both the baseline setting as well as the next 3 months to monitor the area where 3 new and additional pieces of primary production equipment were being deployed.
- 3 > The task group proposed to monitor the results in the assessment phase directly via live data fed to a control room in the ventilation managers office.
- 4 > Key personnel also wanted full access to this data live 24/7 on smart devices such as mobile phone desktop, laptop, and tablets to accommodate access for off-roster staff.

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CASE STUDY – Western Australia Gold Mine

The Discovery Phase

- 1 > A dedicated diesel management committee (sponsored by the Mine Manager) undertook the evaluation and next steps plans were implemented. The team included representation from Ventilation, Operations, Maintenance and OH&S.
- 2 > The initial DPM levels were higher than anticipated and continued to increase. Previous methods of random sampling had identified issues, however could not pinpoint the problem area or the underperforming controls.
- 3 > With 24/7 monitoring, site discovered that in periods of high activity the dilution of DPM was considered **insufficient**.
- 4 > On the back of these results, a comprehensive consultant led ventilation survey was initiated. Investigations led to the discovery of a **compromised** ventilation system.

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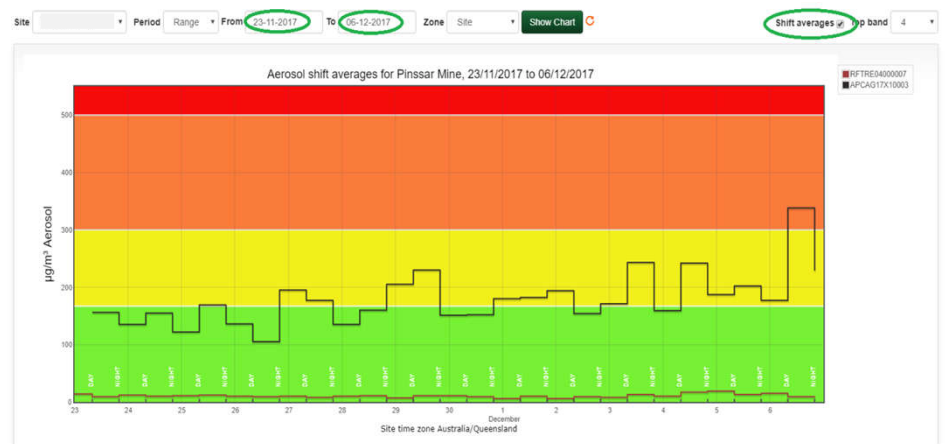
CASE STUDY – Moving More Tonnes Safely



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CASE STUDY – Moving More Tonnes Safely



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CASE STUDY – Western Australia Gold Mine DPM Monitoring Results (continued)

The data clearly articulates periods of activity including peak activity during the 12-hour shifts. The data also highlights the effect the 'end of shift' has on the DPM levels near the working face.

Whilst this dilutionary effect is noticeable, it does indicate the ventilation effect in this instance could only be regarded as being moderately effective.



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CASE STUDY – Western Australia Gold Mine OUTCOMES / Continuous Improvement



The data from the system in conjunction with the ventilation survey helped justify an upgrade.



PPE was reviewed and new technology trailed and utilised.



Greater focus on diesel particulate filters / their change out schedules as well as the maintenance practices.



One of the key initiatives was to continue baseline monitoring with a business wide focus on the DPM mitigating controls. This was done in conjunction with the site's contract mining company.



DPM levels are now considered to be within company OEL's.



The system remains a vital component in the operation today and the business recently purchased more units.



Interestingly—in the first few years, no messaging was used in communicating with general site personnel. However, in recent months, sites have started posting baseline data on message boards.



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CASE STUDY : – Continuous, real-time data used to reduce DPM levels

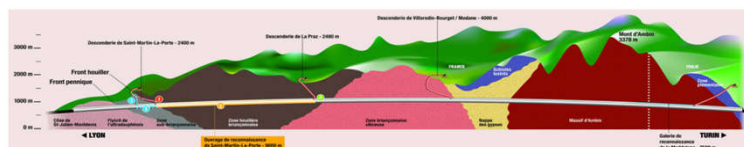
A tunnelling joint venture in Europe was in the dark when it came to monitoring diesel engine exhaust emissions. With the data provided from continuous real-time DPM monitoring, the OHS team recognised the importance of real time decision making when protecting workers from a Group 1 carcinogenic.

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CASE STUDY – Lyon-Turin tunnel

The Lyon-Turin tunnel is a 57km rail link project that will provide a mixed passenger/freight rail service through the Alps



Client : Tunnel Euralpin Lyon Turin (TELT)

Contractor :
SMP4 consortium of 6 companies

- Spie batignolles TPCI,
- Eiffage Génie Civil,
- Ghella,
- CMC di Ravenna,
- Cogéis
- Sotrabas

CHANTIER
SMP4
Projet Lyon-Turin

spie batignolles

EIFFAGE

Ghella

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CASE STUDY – Lyon-Turin tunnel

The Challenge

- 1 > The SMP4 scope comprised of 9km of TBM and 3km of drill and blast works. The drill and blast section of the project was anticipated to produce an undesirable Diesel Particulate Matter (DPM) load and therefore represented a potentially unreasonable risk to workers.
- 2 > Previously, the monitoring regime consisted of real-time fixed gasses, monthly personal monitoring for crystalline silicosis and weekly air flow surveys.
- 3 > Based on their unknown anticipated DPM load, the OH&S department set out to investigate monitoring solutions which resulted in the purchase of a monitoring solution based on its ability to produce real-time DPM data.
- 4 > The Reader was installed in Dec 2018 and immediately provided valuable data on DPM levels. Key personnel also wanted full access to this data live 24/7 on smart devices such as cell phone, desktop, laptop, and tablets to accommodate access for off-roster staff.

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CASE STUDY – Lyon-Turin tunnel

The Discovery Phase

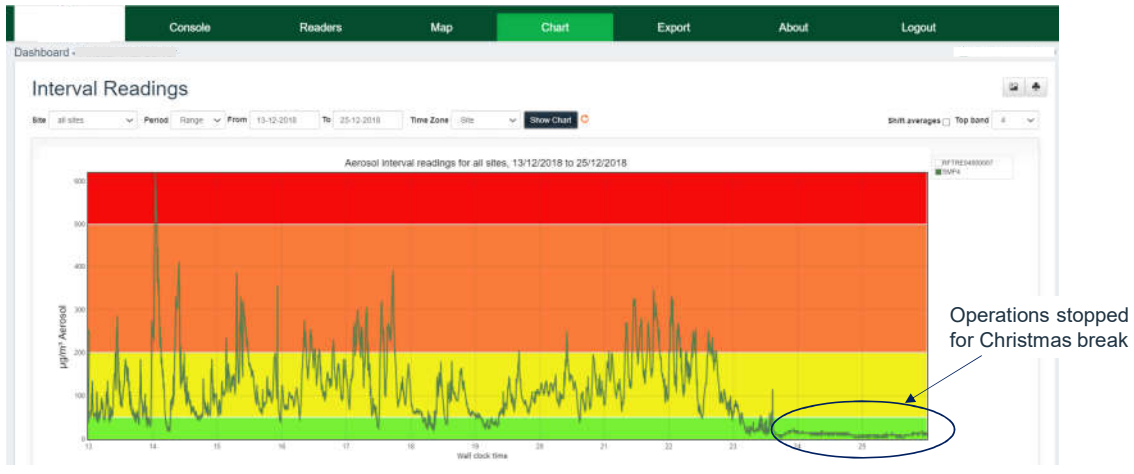
- 1 > The site undertook an initial 3 weeks monitoring program to establish the average base load, the data averaged 180 µg/m3 over this time.
- 2 > Operations were halted over the Christmas period, however the monitor continued to operate, providing the data of just 10 µg/m3 for the period.
- 3 > Following evaluation of the pre-Christmas results, management decided to change the airflow and ventilation parameters.
- 4 > The results were immediate with the data showing an average DPM load exposure falling below the desired 50 µg/m3 during operation..



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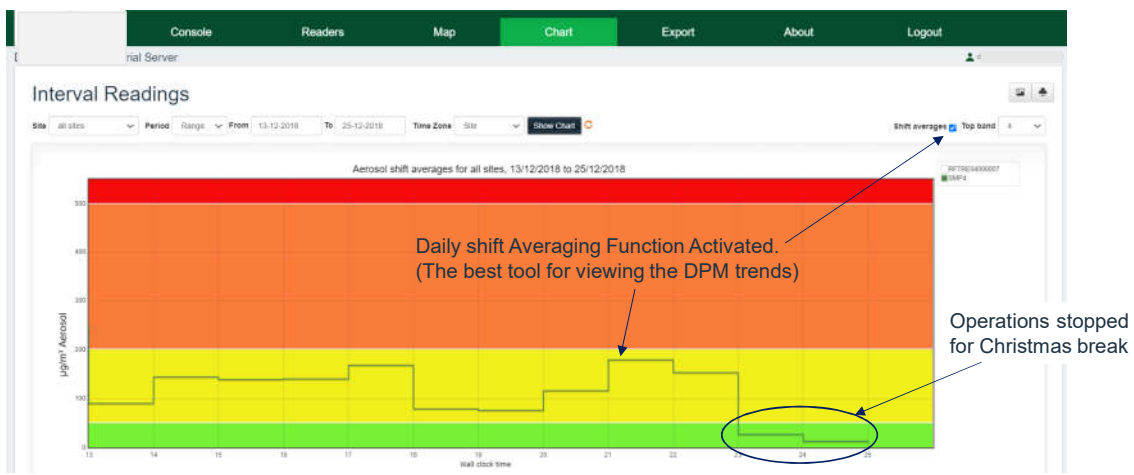


CASE STUDY – Lyon-Turin tunnel



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CASE STUDY – Lyon-Turin tunnel



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CASE STUDY – Lyon-Turin tunnel

The data clearly articulates periods of activity prior to Christmas. The data also highlights the effect of the workforce stopping for 3 days over Christmas.

Once work recommenced, following the change in ventilation, the data clearly shows a vast improvement post Christmas compared to pre-Christmas.



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CASE STUDY – Lyon-Turin tunnel OUTCOMES / Continuous Improvement



The system showed the operation for the first time they could now continuously monitor DPM levels.



The data highlighted to the management of the operation that levels were too high.



Management made a data-based decision to adjust the ventilation, the continuous data then validated the decision.



One of the key initiatives was to continue baseline monitoring with a business wide focus on the DPM mitigating controls.



For standard tasks, DPM levels are now considered to be within company OEL's.



For non-std tasks, PPE is required where the DPM levels exceed the company limit.



The system remains a vital component in the operation today.

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How can real-time DPM monitoring protect ?



People

- ✓ Helps support the goal of zero harm.
- ✓ A healthy workforce is an efficient workforce.
- ✓ Support morale and be recognised as an employer of first choice for skilled workers.
- ✓ Provides data to communicate positive and proactive health messaging to the workforce and the community.

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How can real-time monitoring protect ?



Progress

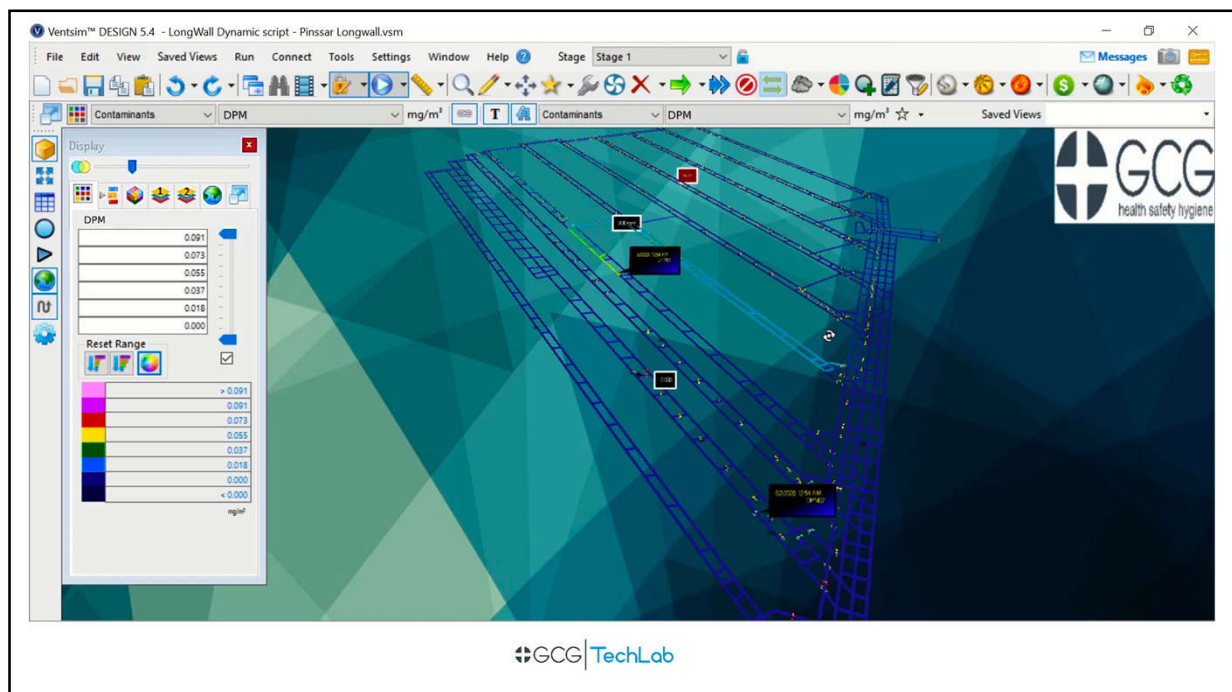
- ✓ Protects your progress, eliminate the risk of shutdowns due to unsubstantiated diesel exceedance concerns.
- ✓ Introduce more production equipment safely, based on real-time data.
- ✓ Streamline operational costs (i.e. vent) by linking your controls with data-driven decisions.
- ✓ International tunneling leading practice for DPM monitoring. (BS6164)

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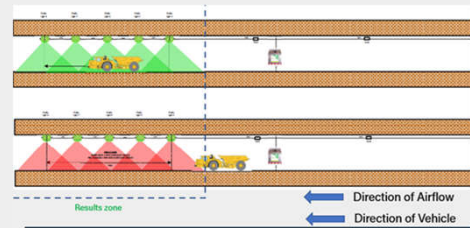
DEMONSTRATION VIDEO

VENTSIM



Block Light Systems

- Block Light Systems with situationally aware LED smart lighting – where by a Zone is declared a Go or No



- Establish a go/no go based on Realtime DPM data
 - Visual at district for driver (traffic light)
 - Alerts via SCADA / emails to key stakeholders
- Take further action – TARPS



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Thank you

