# Micro Pulse LiDAR Monitors Air Quality at Mining Sites in Real Time

## Early Detection of Adverse Particulate Matter Aids Dust Management

Dust emissions at open-cut coal mines are a potential threat to air quality in surrounding areas. To learn more about particulate matter (PM) and how it travels beyond a mine's boundaries, a research grant from the Australian Coal Association Research Program (ACARP) was awarded to Pacific Environment, an environmental consulting firm based in Sydney, Australia. After reviewing several technology options, Pacific Environment selected the MiniMPL (Micro Pulse Lidar) to gather data in field trials. The MiniMPL provides a superior ability to identify and monitor atmospheric particles and to create a three-dimensional (3-D) view of the movement of suspended PM.

## Addressing Health Concerns with Real-time Air Quality Monitoring

Routine mining activities such as blasting and hauling create dust in the atmosphere that is potentially harmful if it enters the respiratory systems of people. Although coarse PM typically falls to the ground within the boundaries of the mine, finer PM can be transported over longer distances and are considered inhalable. This raises concerns about the long-term health impact of the dust emitted from open-cut mines.

"The MiniMPL's real-time scanning capabilities allow mine operators to better manage on-site dust emissions, reduce unnecessary production stoppages, and improve general air quality in the area," explains Damon Roddis, National Practice Leader - Air Quality and Noise, Pacific Environment. "The unit uses a low power/high repetition laser with a typical range of 15 km, and it has dual polarization capabilities that are crucial for identifying PM."

After set-up, the MiniMPL system operates autonomously and gathers data at a selected time interval. The system and laptop are housed inside a specialized weatherproof enclosure with an optical transceiver unit placed on top. The range resolved signal is recorded and displayed in real time on the data acquisition computer.

The continuously collected information measures both the perpendicular and parallel polarization components of the backscattered light. Dust particles are typically non-spherical, while spherical atmospheric aerosols (usually moisture) include water vapor, fog, mist and rain. When the MiniMPL system is used with a geographic information system (GIS), the trajectory of plumes can be overlaid on a map, allowing the user to pinpoint the origin of the plume and the direction the plume is traveling with a high degree of accuracy. This information is useful for early warnings to surrounding neighborhoods in case of an adverse event.

## Field Trials with the MiniMPL

Pacific Environment collected field data at three locations in Australia: the Hunter Valley Operations, a multi-pit open-cut coal mine operated 24 hours a day, seven days a week; the Mount Thorley Warkworth area, comprised of two adjacent open-cut mines; and Fort Scratchley at the Port of Newcastle, the largest bulk shipping port on the east coast of Australia and the world's leading coal export port.

"As an open-path monitoring system, the MiniMPL offers an advantage over single-point monitors of various types," said Roddis. "The accuracy of single-point monitors is greatly impacted by site location and wind direction, while the MiniMPL measures along a path length of hundreds of meters and provides an integrated measure of PM moving through a line."

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*– Damon Roddis, National Practice Leader – Air Quality and Noise, Pacific Environment*

## Effective Detection of Dust Emissions

Analysis of the MiniMPL data, including comparisons to returns provided by conventional particulate monitors, shows the system is effective for identifying PM emission sources and PM movements across critical site boundaries, such as fence lines and open pits.

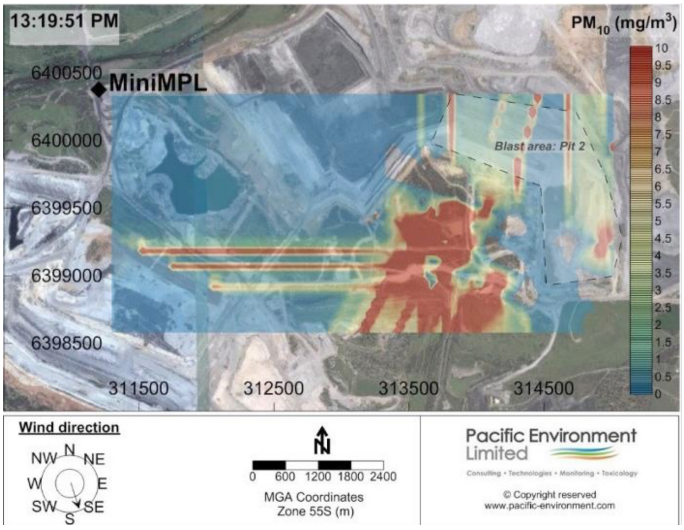
"Monitoring at a range of sites, including a chemical plant, a grain depot, a shipping channel, and multiple coal mines, demonstrated that both spherical and non-spherical aerosol plumes can be identified using the MiniMPL data," said Roddis. "In the future we hope to conduct longer field trials to provide additional insight into how best to use the data to help maintain air quality in areas impacted by industrial dust sources."

## About Micro Pulse LiDAR

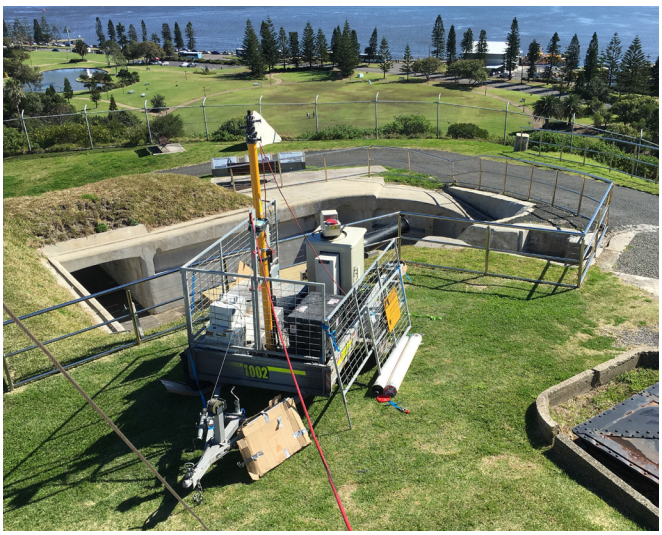
**Elevating Atmospheric Monitoring**

Micro Pulse LiDAR (MPL) instruments, help scientists, meteorologists and air quality professionals monitor clouds and aerosols to better understand the structure of our atmosphere. MPL's long-range capabilities and high-quality signal increase efficiency and accuracy of the data capture process for improved atmospheric monitoring. Originally designed by Sigma Space for NASA, MPL uses eye-safe lasers, precision photon counting electronics, and built-in data analysis to deliver the best signal-to-noise ratio and thus the most reliable information in this category.

*Micro Pulse LiDAR is part of Droplet Measurement Technologies, LLC a leading solution provider of cloud and aerosol instruments.*




*PM10 concentrations over Cheshunt Pit, HVO during a blast event on 15/7/16 mapped onto satellite imagery of coal mine.*



*MiniMPL overlooking the Port of Newcastle.*

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