SURFACE COAL SOLUTIONS

At Orica, we’re focused on developing long term partnerships which reduce total cost of mining, improve productivity and enhance your licence to operate. We combine the progressive thinking of our Global R&D and Technical networks to find solutions to the challenges you face every day.

Blasting Systems | Ground Support | Mining Chemicals

orical.com
Our range of services, blasting systems, ground support and mining chemicals is uniquely positioned to deliver results for the surface coal market.

**BLASTING SYSTEMS**

**Bulk Systems**
Orica’s Bulk Explosives offer the broadest range of energy in the market, with systems ranging from less than half, to almost triple the Relative Bulk Strength of ANFO. With additional options in Velocity of Detonation, you have greater choice and unprecedented control of blasting outcomes in all rock types.

**Electronic Blasting Systems**
Our Next Generation of Electronic Blasting Systems harness the latest developments in blasting technology to ensure greater control of energy in the rock mass. i-kon™ II is the benchmark system for use in high value and complex blasts at surface operations.

**Initiating Systems**
Orica manufactures and distributes the widest range of conventional electric and non electric detonators, boosters and detonating cord globally. Our Initiating Systems provide the highest level of safety, reliability and ease of use. They’re backed up by a global network of manufacturing and assembly plants to ensure reliable supply.

**Packaged Explosives**
Our extensive range of Packaged Explosives provides outstanding product performance. With excellent shock and heave energy, Orica’s Packaged Explosives are safe, easy to use and reliable.

**Services**
Orica’s service delivery model offers a wide range of options to improve your blast loading productivity and optimise your blasting results. The range of options includes engaging Orica to deliver bulk explosive into the blasthole, through to a fully managed fee-for-performance contract that delivers broken rock to an agreed specification.

Our team of mining engineers, blasting technicians and product support specialists are enabled by a comprehensive range of design, modelling, measurement and survey tools as well as sophisticated delivery systems.

**GROUND SUPPORT**
Through an extensive Ground Support offer, Orica works with you to overcome the challenges of mining productivity and safety in a wide range of geological conditions.

**MINING CHEMICALS**
Orica offers a range of chemical products for mining.

We are dedicated to safe chemical handling to protect your employees, the environment and your reputation. We also strive to reduce your onsite costs and increase plant efficiency.

Dedicated manufacturing facilities and sound contingency planning will help keep your operations running at optimum efficiency and safety levels. Orica also provides a 24/7 emergency response and technical advice.

For further information visit orica.com/contact and we will connect you with your regional customer solutions specialists.
**CASE STUDY**

**MAXIMISING PRODUCTIVITY AND COAL RECOVERY IN DIPPING COAL SEAMS**

**WAHANA BARATAMA MINING, INDONESIA**

**THE SITUATION**

Wahana is a multi-seam thermal coal deposit in Indonesia, consisting of many seams of variable thickness and dip (slope). Seams as thin as 200 mm are separated by interburden between two metres and 12 metres thick. The highly variable geology makes it difficult for geologists and planning engineers to accurately predict the location of coal seams prior to drilling.

Conventional techniques for blasting in this deposit were inefficient and expensive. A large number of small blasts were fired every day, causing frequent stoppages and low utilisation of the mining fleet (Figure 1). Many small drills and excavators were required to selectively drill, blast and mine, creating a congested and confusing working environment in the pit.

As mining progressed, it became evident that a more efficient drilling, blasting and mining process would be required to achieve higher production targets. The strong partnership between Orica and the mine operators enabled Orica’s site based blasting engineers to trial through-seam blasting techniques, with the aim of increasing the consistency of broken interburden for the excavator fleet without diluting the coal seams. The trial included a detailed time study of the productivity of the load and haul fleet using conventional and through seam blasting methods.

**SITE PROFILE**

Wahana is an open cut coal mine located in Satui, South Kalimantan, Indonesia, approximately 200 kilometres south-east of the capital, Banjarmasin. The project is owned by Wahana Baratama Mining, serviced by PT Leighton Contractors Indonesia.

Mining is carried out using a conventional open pit truck or shovel operation.

**TECHNICAL SOLUTIONS**

Through seam blasting is a special blasting technique that enables a single, large blast to span multiple coal seams, thereby reducing drill and blast cycles while maintaining coal recovery (Figure 2). Explosives are charged beneath and above the seams in each blasthole and aggregate is used to protect the coal seam. Vertical advance is also enhanced as it is not limited by the roof and floor of the coal seam

Successful through seam blasting demands accurate location and mapping of the coal seams and adjacent strata. To achieve this Orica integrated gamma density geophysical logging techniques with the SHOTPlus™ blast design software. This software is unique in its capability to handle complex, multiple dipping coal seams with automatic loading rules. The updated coal model allowed the appropriate design of explosives for each individual blasthole in terms of quantity and location to sufficiently break the rock and not damage the coal seams. The use of i-kon™ electronic detonators was essential to manipulate the blast timing between decks.

Wahana Baratama Mining has found real benefits at our mining project through the introduction of Orica’s through seam blasting system. Our overall productivity and performance in both coal and overburden mining has increased with quicker coal exposure and more than 50 per cent increase in the vertical advance of our mining blocks in the overall operation. Orica’s gamma logging of drill holes also gives us the opportunity to update our current pit model with more accuracy, which assists our mine planning sequences and schedules.

**Trevor Newey**

Mining Manager Wahana Baratama Mining

**THE RESULT**

The trials demonstrated the full value of through seam blasting versus the conventional mining method.

The results showed increases in mining productivity through easier bench preparation, increased drill productivity and reduced delays. The technique reduced blast events by 80 per cent, enhanced the dig rate by 61 per cent and reduced the drilling requirements by 55 per cent.

The improvements in coal model accuracy also reduced dilution issues, enhanced reserve estimates and assisted with the build-up of broken inventory.

The trials saw the site convert the majority of its blasting operations to the through seam method. Orica continue to support Wahana with through seam blasting to deliver consistent coal recovery and reduced blasting costs, extending the mine life in a challenging macroeconomic environment for thermal coal producers.

**KEY OUTCOMES**

- **BLASTING EVENTS REDUCED BY 80%**
- **ENHANCED COAL RECOVERY**
- **INCREASED BLAST SIZE FROM 25,000 TO 200,000 BANK CUBIC METRE (BCM) ON AVERAGE (TRIAL)**
- **61% HIGHER DIG RATE**
CASE STUDY
A HOLISTIC APPROACH TO MANAGING BLAST OUTCOMES
HUNTER VALLEY OPERATIONS, HUNTER VALLEY, NSW

THE SITUATION
The Riverview West Pit at Hunter Valley Operations (HVO) has faced increasing production challenges in recent times due to decreasing dragline strike lengths and increasing environmental constraints on vibration, overpressure and fume generation. This pit is in close proximity to high voltage power lines and a major public road as well as various townships, homesteads, vineyards and indigenous heritage sites.

Recently HVO has targeted three main coal seams. These seams were mined in multiple passes requiring multiple drill and blast cycles. For a typical strike length of 1.4 kilometres, five to six blasts were required to extract all the seams. Each of these blast events posed a serious challenge for HVO to manage the environmental issues without seriously degrading blast outcomes.

SITE PROFILE
HVO is an open cut coal mine located 24 kilometres north-west of Singleton in the Hunter Valley region of New South Wales. The site produces approximately 14 million tonnes of thermal and metallurgical coal per annum.

The site consists of a number of open cut pits utilising both dragline and truck and shovel methods for extraction. The mine is owned and operated by Coal & Allied Industries Limited, a subsidiary of Rio Tinto.

TECHNICAL SOLUTION
By working collaboratively with Orica, it was realised that the blasting method known as Stratablast, in conjunction with advanced computer modelling techniques, could provide productivity gains whilst simultaneously providing more control over the environmental effects and the impact on nearby infrastructure. The technique allows the entire strike length involving all recoverable seams to be blasted in a single blast event, consisting of both throw and several stand-up blast layers, designed to optimise the overall blast result.

As most blasts were very large (more than 1100 metres long), initial designs included a large factor of safety to ensure compliance with environmental limits. More than 800 holes and a total charge weight of around 1000 tonnes of bulk explosives were used for each blast.

Considerable effort was devoted to controlling vibration. Detailed individual blast modelling was required for each blast and a range of changes to the blast design were trialled to ensure the resulting blasts stayed within vibration limits. Once vibration control was achieved, the design team then focused on balancing and prioritising multiple environmental and blast performance outcomes, such as increasing the percentage of overburden cast to final spoil.

11 blasts have been designed and fired. After each blast, design changes have been iteratively implemented to provide further control and to continually improve productivity.

Blasts have progressively increased in complexity with the inclusion of features such as damage zones (regions of early-firing blastholes), mid-splitting, time gaps and different directions of firing. The consequence of this complexity is that the blast duration can be as long as 28 seconds to accommodate all components of the blast.

THE RESULT
Using the new method, HVO did not have any reportable fume events or statutory exceedances of overpressure or dust. Vibration compliance improved throughout the project due to the combination of advanced modelling and novel blast designs. With prediction and control of environmental outcomes, other blast metrics have become the focus of improvement, including:

• Recovery of thin coal seams previously deemed uneconomic;
• Negligible coal loss or damage ensuring complete recovery;
• Streamlining of mine planning and resource management, resulting in better overall mining efficiency;
• Increasing dragline productivity and avoiding excess dragline downtime; and
• Increasing overall drill and blast productivity.

This project has increased the productivity of the Riverview West Pit and allowed the environmental impacts to be managed with far more control and predictability than would have been possible under a conventional blasting regime.

Undertaking such large and complex blasts necessitates intensive campaigns with high resource utilisation. The success of this project was underpinned by strong teamwork, communication, experience and technical capability of Orica and the HVO team.

KEY OUTCOMES
– VIBRATION CONTROLLED WITHIN THE ESTABLISHED LIMITS
– NO FUME OR OTHER ENVIRONMENTAL EXCEEDANCES
– INCREASED COAL RECOVERY
– STREAMLINED MINE PLANNING
CASE STUDY
ENVIRONMENTAL MANAGEMENT
REDUCING BLAST FUMES
NEW ACLAND COAL MINE, QUEENSLAND

"Flexigel™ Clear has proven to be an effective control in preventing post blast fume events. Our production rates have been maintained and in some cases improved. The current density range used onsite is between 80-100. Flexigel™ Clear has assisted us to achieve greater control of powder factors. The lower density has improved the explosive distribution in the blast and no major slumping has been observed in loaded blastholes."

Chris Bartley, NAC Drill and Blast Coordinator, New Hope Group

THE SITUATION
The New Hope Group is strongly committed to high environmental and community standards. At the New Acland Coal Mine (NAC) in Queensland this commitment drove the mine to concentrate on a joint program with Orica to eliminate post blast emissions of oxides of nitrogen (NOx) in their mining operations.

Orica commenced blasting services at NAC in January 2013 with the agreement centred around Key Performance Indicators (KPI) for services and bulk explosives that are specifically geared toward the reduction of NOx fume events Figure 3 illustrates Orica’s fume risk reduction methodology.

NAC blasts around 15 million cubic metres of overburden to produce 10 million ROM tonnes of coal annually. Site geology includes weathered clay and siltstone with basalt flows in overburden and interburden layers between coal seams.

The basalt flows allow groundwater to travel through the overburden. These flows can damage sleeping explosives columns, increasing the risk of post blast fumes. When blasting in soft ground, high energy explosives can also create “bulling”, or large voids in blasted ground, and these present a hazard to personnel and mining equipment.

SITE PROFILE
NAC is a multi-pit, open-cut coal mine situated approximately 150 kilometres west of Brisbane. Bound by rural properties, the New Hope Group is committed to being a responsible organisation towards both the environment and the local community in which it operates.

TECHNICAL SOLUTIONS
Flexigel™ Clear is a low-density, low VOD bulk emulsion explosive specifically designed for soft ground. It provides a cost effective alternative to conventional high density prill based bulk emulsion explosives, with reduced risk of post blast fume generation. Flexigel™ is specifically designed to yield more heave and less shock energy than conventional bulk products, making it more suitable to blasting in soft ground where bulling is a problem. Flexigel™ contains no AN prill and is therefore extremely robust in dynamic groundwater conditions. Its low density allows better distribution of energy for more consistent results in soft ground where a high powder factor is not required.

THE RESULT
Flexigel™ Clear has proven to be an effective control for post blast fume events. 5,680 tonnes of Flexigel™ have been used to blast around 16 million BCM of overburden over a two year period. In this time the site has experienced only four minor localised fume events, with no measurable impact on mine production rates.

A major contributor to the success at site is the strong relationship between Orica and NAC. Daily communication combined with monthly business reviews has promoted a proactive, versatile and efficient partnership approach.

KEY OUTCOMES
- PREVENTED POST BLAST FUME EVENTS
- PRODUCTION RATES MAINTAINED OR IMPROVED
- ENHANCED MINE SCHEDULING THROUGH ELIMINATING DOWNTIME