WHITEHAVEN COAL

WERRIS CREEK COAL MINE
BLASTING FACT SHEET

BLASTING SUMMARY

Werris Creek Coal mine has been operating since 2005 with the current Project Approval 10_0059 outlining the limits to blasting. Blasting is required to break and fragment the rock overlying the coal seams so that the rock material (now known as overburden or spoil) can be efficiently excavated and transported to the dump allowing the coal to be mined productively.

BLASTING LIMITS

The Project Approval 10_0059 and Environmental Protection Licence 12290 limit the maximum blast results to be:

- Vibration: 10 millimeters per second (mm/s); and
- Overpressure: 120 decibels (dBL).

In addition, blasting is only allowed once per day (except if the blast result is <0.5mm/s or required for safety reasons) and between 9am and 5pm Monday to Saturday.

Two drills drilling a drill pattern

Shotfirer supervising loading blast hole from Explosives Truck

BLASTING PROCESS

A Blast Engineer will provide an initial design for an area in the mine to achieve the require production objectives and vibration less than 1mm/s to minimise community complaints. The blast design is given to a Driller who drills the holes at the designated location, depth and hole diameter. A Shotfirer checks that the holes have been drilled correctly and proceeds to pump explosives from an explosives truck down each hole in accordance with the blast design. The Shotfirer connects each hole together with a booster and detonator cord. The speed that each detonator cord transmits is determined by the Blast Engineer to minimise the number of holes blasted together.

Werris Creek Coal will delay a blast to avoid when the wind is towards Werris Creek town or during gale force winds. The Shotfirer asks for a pre blast weather check to avoid impacting on Werris Creek town and then detonates the blast area called a shot to explode the explosive resulting in fragmented rock. The energy released from the explosives is transferred through the ground as a vibration wave or transferred into the atmosphere as an overpressure wave, part of which is audible to humans.

BLASTING OVERPRESSURE

Explosive energy that is released into the atmosphere generates an airblast (overpressure) wave that travels at 340m/s and is measured in decibels (dBL) using a device called a sound level meter (like a microphone). Overpressure is the second aspect of a blast to be experienced by the community and can be felt due to the pressure wave interacting with houses and other structures (similar to a large truck passing close by). Blast overpressure levels recorded in Werris Creek are less 120dBL which is the maximum limit allowed in approvals. Structures are safe up to 133dBL from any damage due to blasting.

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BLASTING VIBRATION

Ground vibrations generated by blasting are the sum of three types of waves (P, S and Rayleigh waves) that travel between 700 metres per second and 2200 metres per second. The blast vibration is measured by a device called a geophone that is fixed to the ground and combines together three direction measurements to give the peak particle velocity in millimeters per second (mm/s). Typical blast vibration frequency (the number of wave peaks per second) is between 2 and 26 Hertz.

Vibration waves are the first aspect of a blast to be felt by the community and are generally only experienced by a person when in a building or other structure. Blast vibration levels recorded in Werris Creek on average are less than 0.5mm/s which is the limit of human perception. The blast vibration limit is 10mm/s. Vibration levels required to initiate the onset of cosmetic cracking are approximately 26 and 35 mm/s (>75mm/s for structural damage). Natural resonance of homes is between 9 and 11 Hertz which can enhance the perception of shaking.

Typical blast at detonation

Completed shot ready to be blasted

EXPLOSIVES AND FUME

The base explosive used in mining is called Ammonium Nitrate Fuel Oil (ANFO). Oxides of Nitrogen can be inadvertently generated as fume by the incomplete detonation of explosives during a blast. Specific types of explosives can be used if there is a risk of fume being produced. In the unlikely event yellow to orange coloured fume is generated; a 500 metre exclusion zone around the blast ensures that the fume rapidly becomes diluted and dispersed in the atmosphere. Fume can have an acrid odour but at those low levels of concentration, it is unlikely to pose any acute health risk to the community off the mine site.

BLASTING BY THE NUMBERS

The following table outlines the range and variation in the size and different types of blasts at Werris Creek Coal. Different types of blasts include cast blasts (used to throw overburden), through seam blasts (blast the ground above and below a coal seam without damaging the coal) and standard overburden production blast (fragment the ground to improve dig ability).

Blast Parameter	Min	Average	Max
Number of Holes per Blast	10	300	550
Diameter of each Hole	200mm	-	229mm
Hole Depth	12m	20m	40m
Overburden Volume per Blast	50000m^3	200000m^3	300000m^3
Explosives per Blast	50 tonne	120 tonne	200 tonne
Blast Duration	0.1sec	2.5sec	3sec

BLASTING RESULTS

Werris Creek Coal is required to measure every blast at four locations including two sites within Werris Creek town (corner of Punyarra and Kurrara Street and at the Werris Creek Water Treatment Plant). The following table shows the average and maximum blast results recorded at the Kurrara Street (Werris Creek South) monitor since 2010. Werris Creek Coal blasts on average only twice a week and limited to 15 blasts per month.

Year	Vibration (mm/s)		Overpressure	# of	# of
	Average	Max	Max (dBL)	Blasts	Complaints
2010	0.48	0.51	99.8	102	25
2011	0.44	1.45	113.2	84	71
2012	0.42	1.05	111.0	82	14
2013	0.43	1.19	119.0	86	52
LIMIT	10.00		120.0		

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