middlemount coal

Learnings from Middlemount Mine Highwall Fatality 26 June 2019

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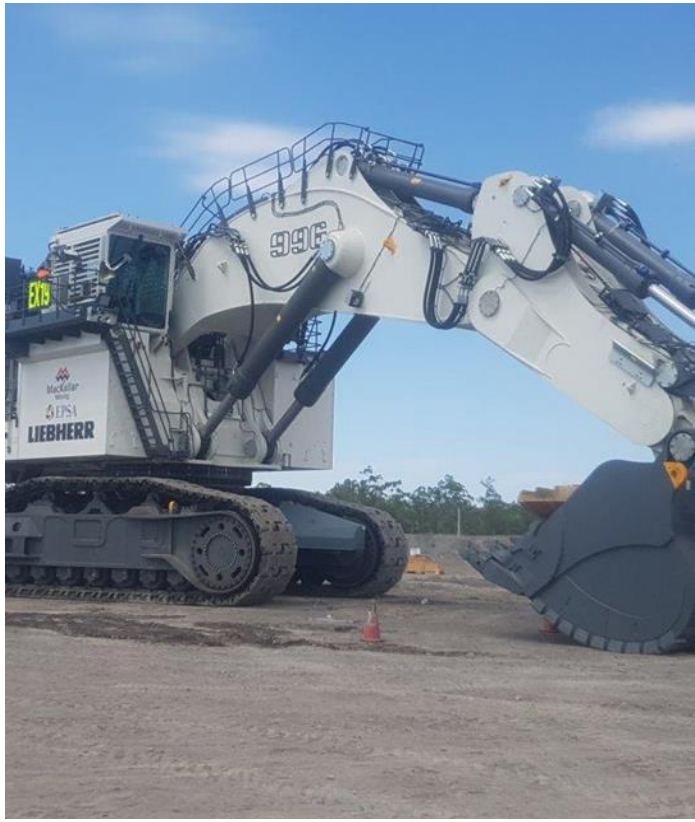


Incident Overview

On Wednesday, 26 June 2019 at approximately 12.20 pm, a 55-year-old coal mine worker (CMW) was fatally injured while he was operating a Hitachi 3600 excavator (EX46) in Strip 19 of the South Terrace Pit. The incident occurred when an adjacent section of the pit wall failed and approximately 7,000 cubic metres of material engulfed the machine partially crushing the excavator's cabin.

The section of pit wall that failed was along the excavation's eastern echelon, next to where it intersected the southern highwall and was approximately 42m higher than the bench where EX46 was working. The failed material was hung-up in front of the presplit line and had not been removed during the mining process as required.

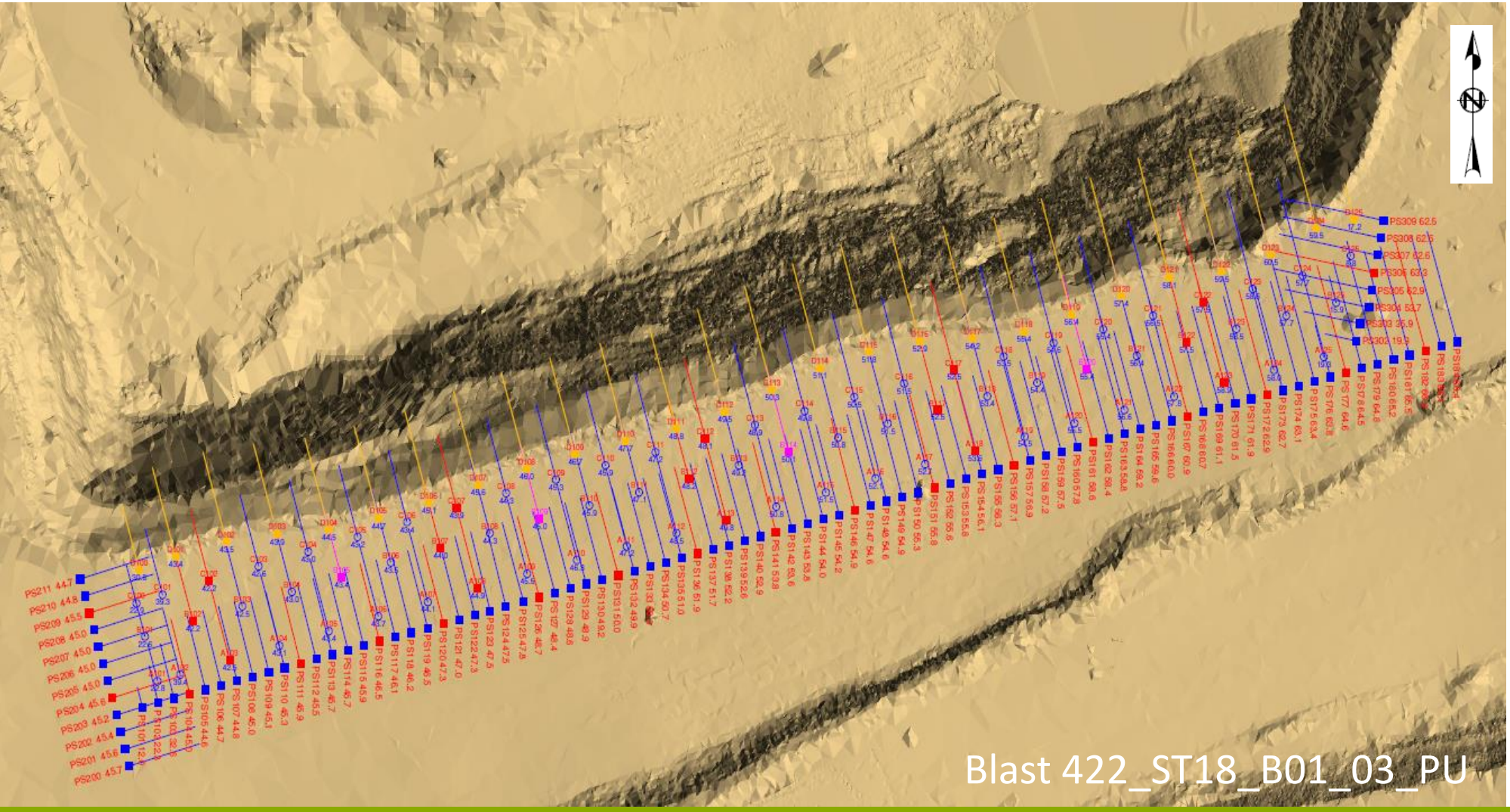
The site Emergency Response Team (ERT) was immediately activated, however due to unstable ground conditions the ERT were unable to gain access to EX46 to extract the CMW. The emergency rescue was an extremely complex and prolonged undertaking due to the large volume of unstable material above and around EX46.

The ERT spent several hours clearing away fallen material from EX46 and cutting the roof off the cabin. This work was extremely laborious especially cutting the roof from the cabin as the steel proved to be much harder than envisaged. The deceased CMW was recovered from the excavator approximately twelve hours later.

Contributing Factors (RSHQ Report 20/03/2020)

1. There was a significant change in the Southern Terrace Pit design which introduced new hazards for which controls were not implemented.
2. There were design, drilling and loading failings in the Drill and Blast process which resulted in poor blasting results.
3. The risk management process for identification and control of the hazards caused by contributing factors 1) and 2) was not implemented.
4. There was a failure to dig to the pit design due to the additional hazards caused by contributing factors 1) and 2).
5. Persons in senior management and statutory positions had knowledge of the section of pit wall being hazardous prior to the incident occurring, but did not act on that knowledge.
6. Coal Mine Workers (CMW's) raised several concerns with the dayshift Mine Supervisors and Open Cut Examiner (OCE) about the instability of the section of pit wall that failed prior to the incident occurring.
7. The dayshift OCE failed to comply with legislative statutory requirements.
8. There were failures of persons to comply with the mine's safety and health management system.

Timeline - 05/06/2019

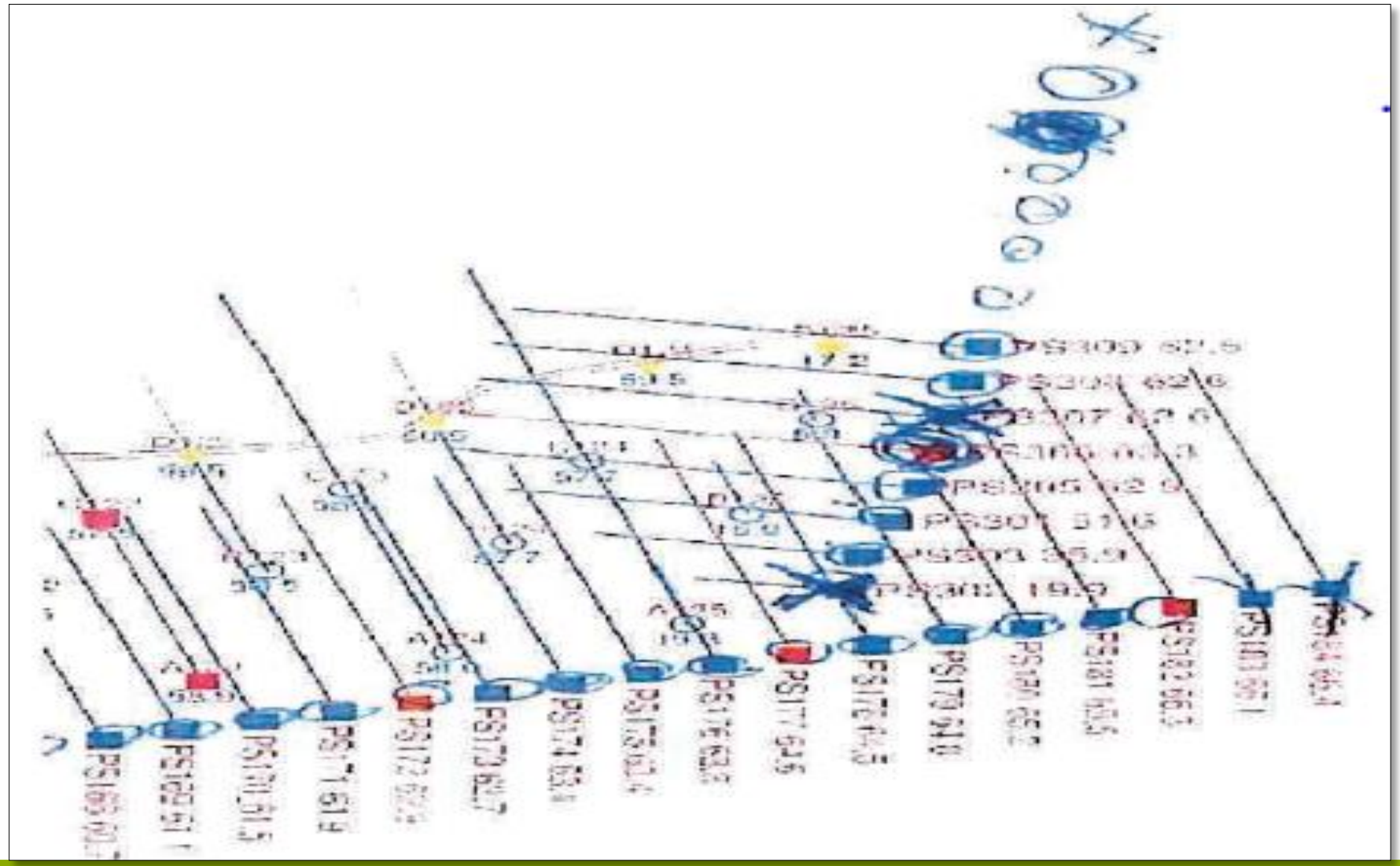


Strip 19 drill design was approved and released. An adjusted version was later released without the appropriate authorization with minor changes to hole alignment and angle.

The eastern echelon design included a presplit to provide a cleaner, straighter wall to expose additional coal at the toe of the pit wall, which was not common practice at Middlemount Mine.

The previous Strip 18 did not include a presplit and subsequently the coal recovery was reduced.

Timeline - 16/06/2019

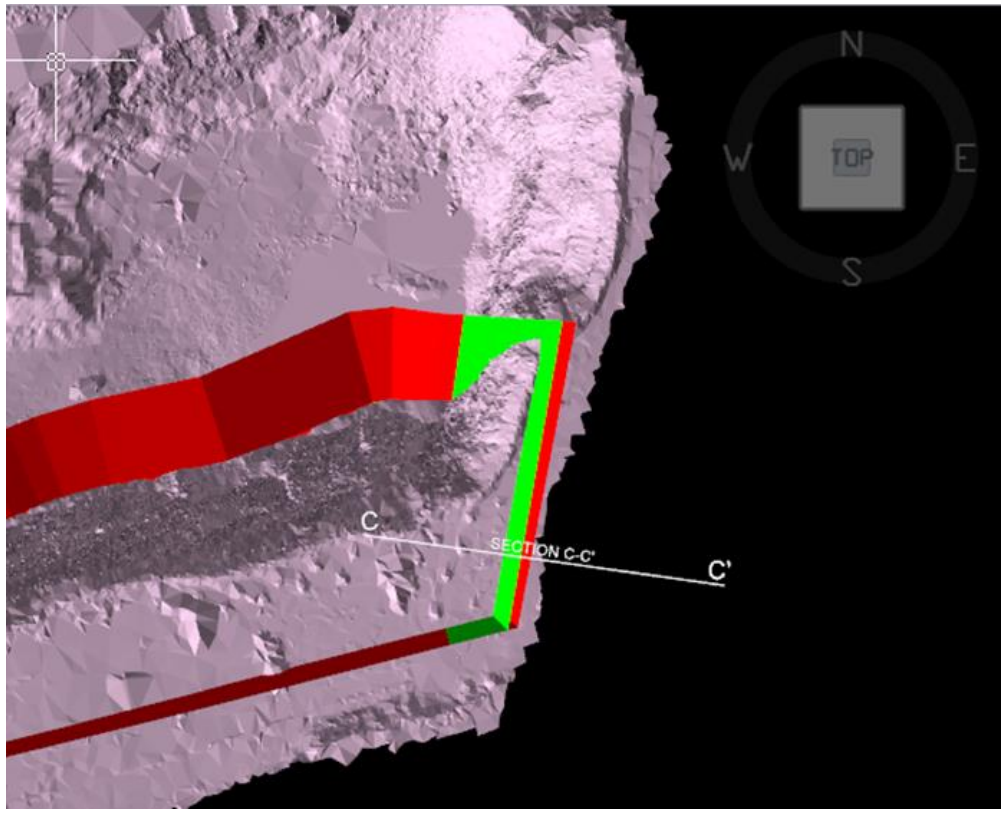


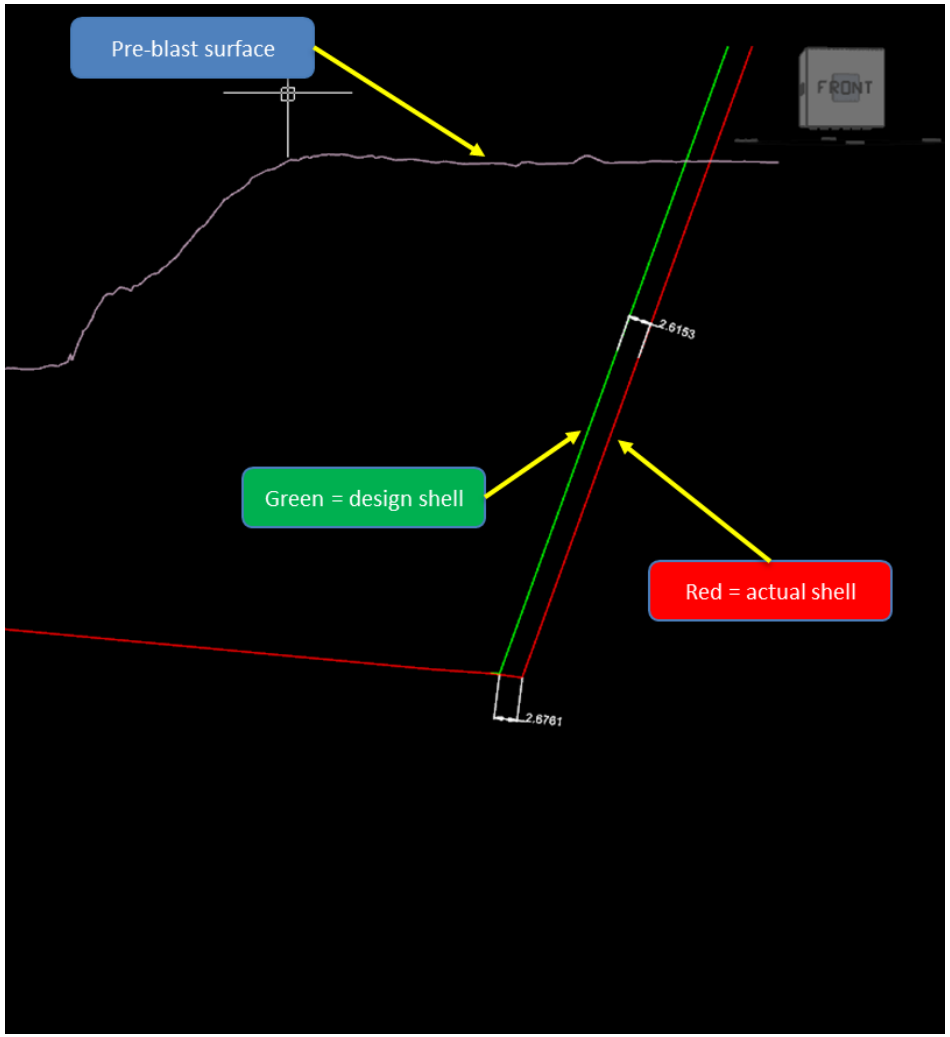
The initial drill design for BL422 (03/06/19) had 14 presplit holes drilled across the eastern echelon wall. The approved drill design showed that there was only 8 presplit holes.

The loading map used by the blast crew was an adjusted version of the original drill design, which indicated that there were 15 holes drilled across the echelon wall.

The loading map also indicated that 4 presplit holes were not loaded with explosives, reducing the powder factor and presplit energy in the immediate area above the incident site.

Pre-Blast Shell





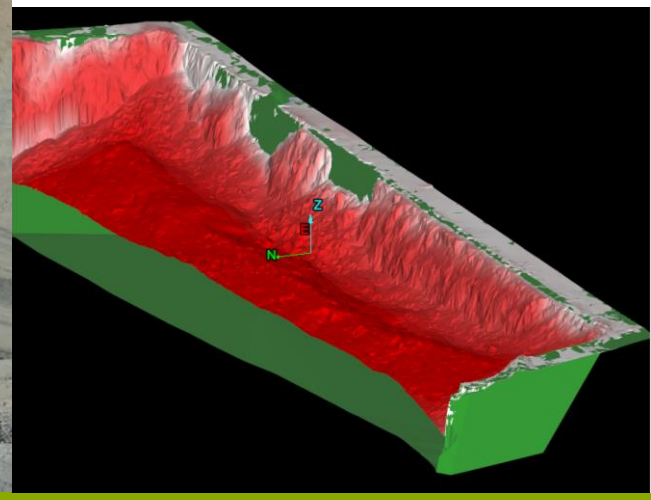
The amended drill design was stepped back behind the original design shell, which was further compounded by the echelon presplit holes being drilled outside the original design parameters increasing the burden spacing and design variance.

Distance between presplit line and production holes was approx. 4.5m to 5.0m (site standard was 2.5m). The A Row burden spacing from the presplit had increased to 9.5m (site standard was 7.0m).

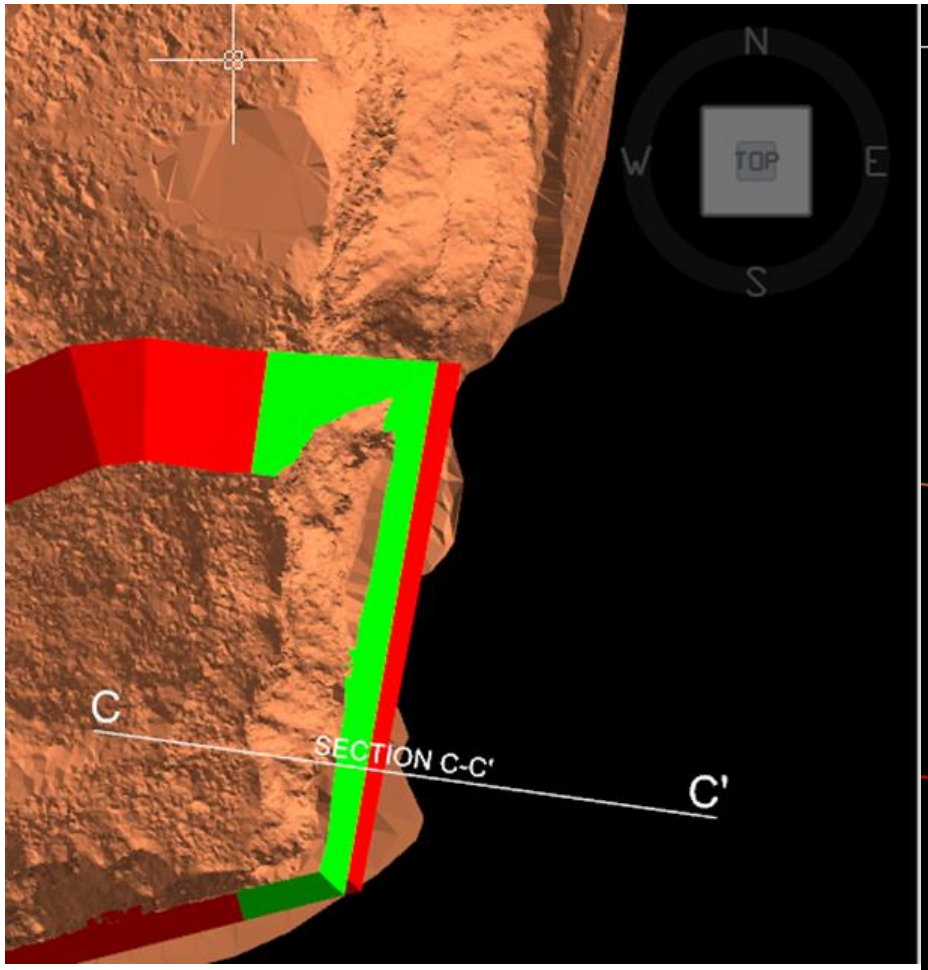
Timeline - 16/06/2019

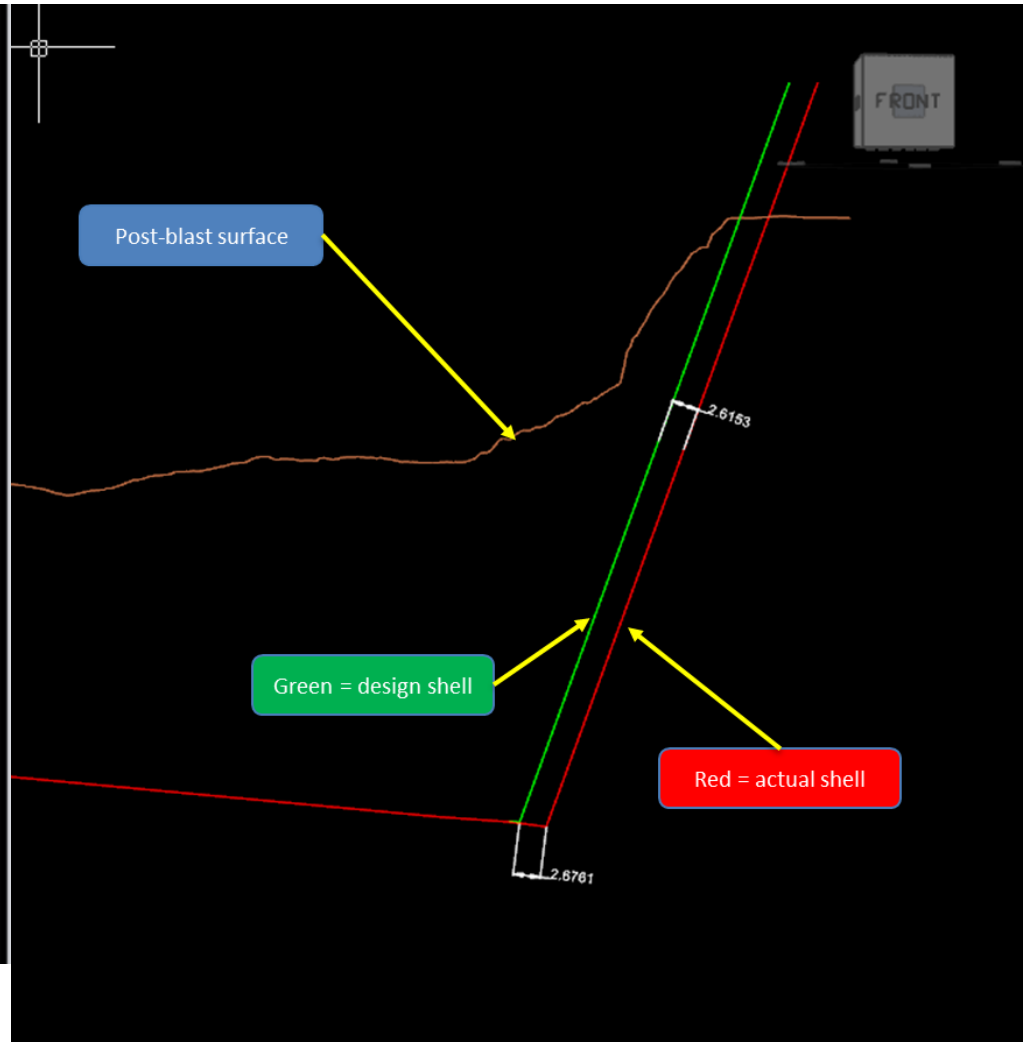
Significant hang-up material evident on southern highwall post blast.

Mining to commence West to East.



Post-Blast Shell





Post blast scan of eastern endwal shows significant amount of material in front of pre-split barrels.

Timeline - 17/06/2019

EX65 created a bench to safely access the crest of the excavation due to narrower than normal strip width of 35m (site standard 60m) due to previous strip being 80m.

EX65 to work east on this level remediating highwall presplit holes and cracking visible on crest of east end wall.

Timeline - 18/06/2019

EX65 continuing to remediate highwall from west to east.

EX46 mining towards the south and benching back towards the east.

EX46 identified hard dig on highwall and reported to Supervisor.

Dozer mining team working from west to east.

Timeline - 20/06/2019

EX27 increasing height of separation bund along edge of haul road near east endwall.

Evidence of pre-split and cracking identified.

Timeline - 20/06/2019

Majority of Southern Highwall presplits barrels now exposed.

EX65 full reach removing echelon hang up.

Timeline - 21/06/2019

EX65 finished cleaning highwall back to pre-split on upper level.

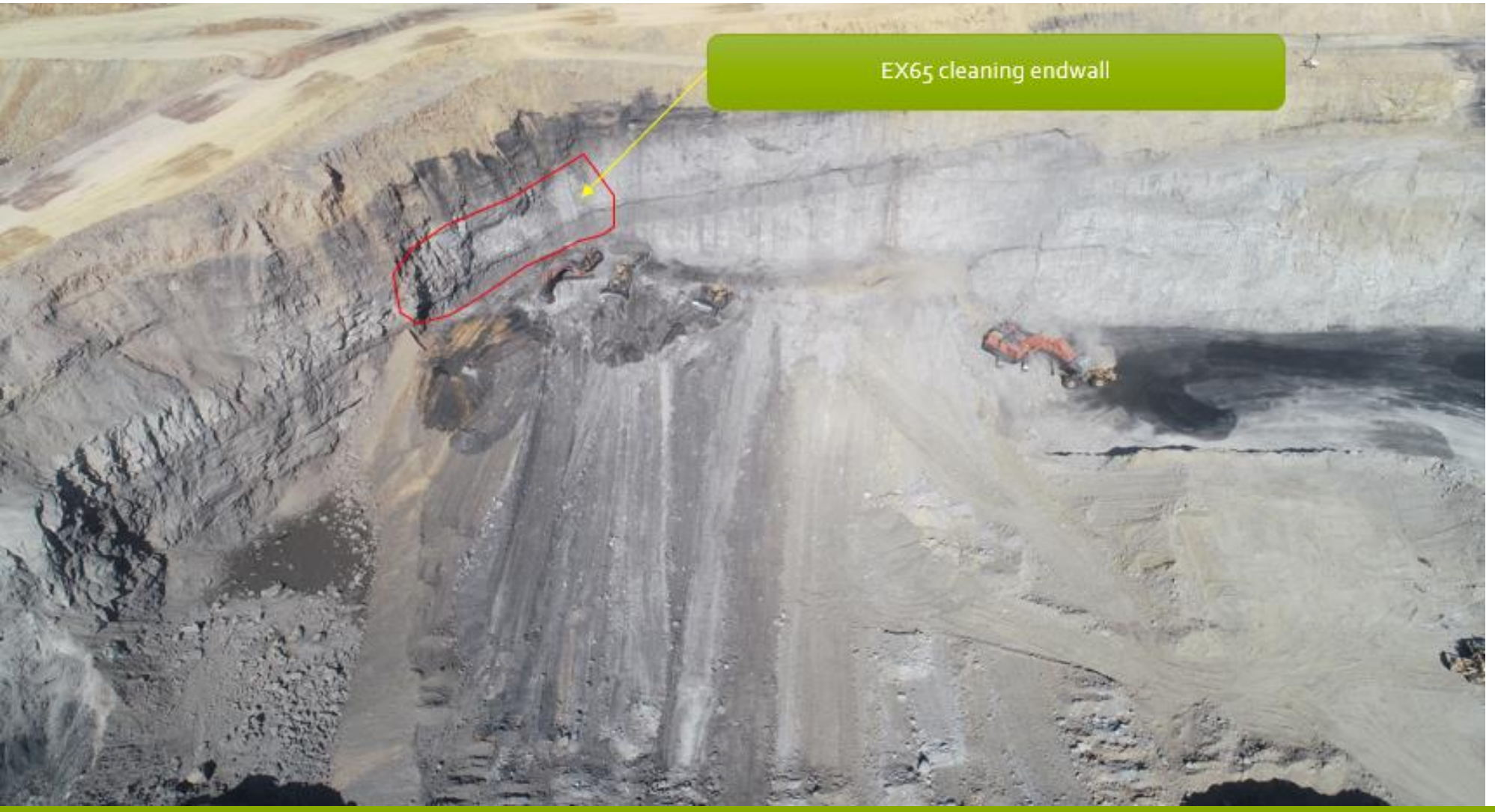
EX46 was digging back to hard on highwall west to east.

Timeline - 22/06/2019

EX46 relocated back towards the west and faced up conventional mine to the east.

EX65 removed loose material at toe of eastern endwall.
Note: Under cutting of east endwall.

Timeline - 23/06/2019



EX46 mining overburden to the east.

Note: There was no significant attempt to dig to the barrels in the eastern endwall echelon or remove the hung-up material.

Timeline - 24/06/2019

Remediation work completed and EX46 mining pisces coal.

Dozer push scan shows 8.15m of material in front of pre-split barrels.

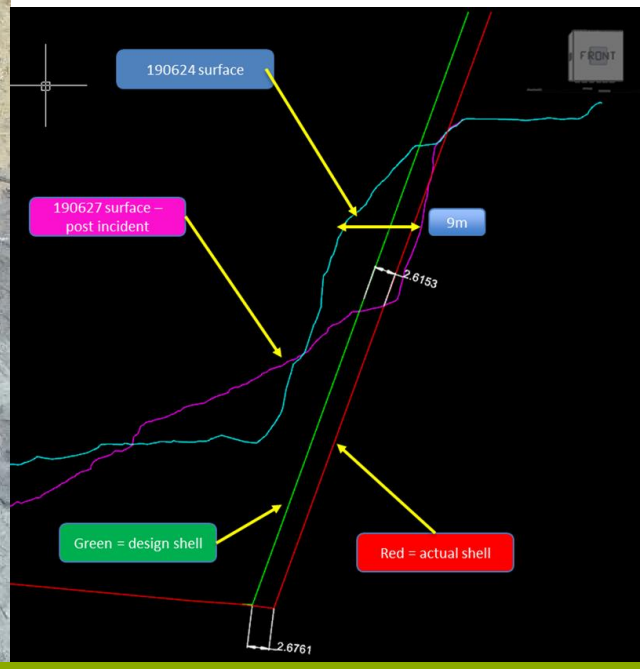
Timeline - 25/06/2019

EX46 is ramping back into overburden working to the east after coal mining completed

Timeline - 26/06/2019

EX46 engulfed by highwall material.

Post incident scan shows approx. 9m of material fell from in front of presplit barrels.



ICAM Analysis (RSHQ Report 20/03/2020)

Absent/failed defences

- The mine did not apply a risk management process to the activities being conducted in Strip 19 Terrace prior to the shot being fired or mining commencing.
- The standard and quality of safety inspections conducted was not adequate.
- The standard and quality of communication regarding the presence of the presplit on the echelon wall was not adequate or effective.
- The standard and quality of communication regarding the presence of the hazard of the hung-up material on the echelon wall was not adequate or effective.
- The Safety and Health Management System did not contain a robust plan and design process for pre and post blasting activities.
- The Safety and Health Management System did not contain a process for identifying and reviewing hazards after a blast was fired and before mining commenced.

ICAM Analysis (RSHQ Report 20/03/2020)

Individual / team actions

- The dayshift OCE did not convey information regarding the presence of the presplit on the echelon wall.
- Senior mine management did not convey information regarding the presence of the presplit on the echelon wall.
- Concerns raised by CMW's about the hazard of the hung-up material on the echelon wall were not managed by the dayshift OCE or Mining Supervisors.
- The Technical Services Department did not have an effective communication and peer review process during the design and approval process for the blast at Strip 19 South Terrace.
- Senior mine management did not ensure that overburden extraction was conducted as to pit design.
- An exclusion bund erected to prevent access to the hazard of the hung-up material on the echelon wall was removed by the following shift. The reason for the exclusion bund was not effectively communicated to the oncoming shift.

ICAM Analysis (RSHQ Report 20/03/2020)

Task / environmental conditions

- Due to poor drill and blast design and operational issues, significant amount of hung-up material was present on walls.
- The 35m strip profile, meant there was a lower blast profile which made it impossible for excavators to scale all the hung-up material off the walls.
- It was unusual to have a presplit on an echelon wall. As a result, there was a lack of awareness amongst operators of the hazards associated with the excavation of the material and the highwall management.
- Due to scheduling and production pressures, the blast design approval process was rushed and as a result a design issue was not detected.
- Overburden removal commenced before as assessment of the hazards caused by the blast was conducted.
- A significant reduction in the powder factor in the area of the echelon, resulted in blocky hung-up material.
- The geological profile contained a weaker lower strata section, as a result the energy from the blast was released through this area and not evenly through the echelon wall.
- Significant attempts were made to scale the hung-up material from the high and end wall. No attempt was made to remove the hund-up from the echelon wall.

ICAM Analysis (RSHQ Report 20/03/2020)

Organisational Factors

- The Ground Control Management Plan was still in draft and not approved, but refenced in the mine's SHMS as being a live document.
- Activities conducted in Strip 19 South Terrace did not comply with the Ground Control Management Plan's requirements.
- The technical services area of the mine was not adequately manned with competent staff,
- Production pressures resulted in a change of pit design to uncover a larger block of coal.
- There was a limited planning and review process of the pit and blast designs between technical services areas, production area and the drill and blast contractor.
- Blast design process was inadequate which resulted in a design error not being detected.
- The Safety and Health Management System did not contain a robust handover process from the technical services department to production post blast.
- The Ground Control Management Plan was still a draft version.

ICAM Analysis (RSHQ Report 20/03/2020)

Organisational Factors

- The Management Structure document does not identify the required competencies for senior positions and supervisors.
- The design of the excavator involved in the incident, saw the operator cabin be positioned facing the echelon wall at time of failure.
- The blast at Strip 19 South Terrace was drilled and loaded not in accordance with the approved design.
- The mine strip design was changed from 85m to 35m for Strip 19 South Terrace.
- There was a blast hole design error in the distance from the presplit holes to the first production holes.
- The overburden material was removed not as to pit design.
- There was no risk management process applied to the extraction of overburden material and the hazard of hung-up material.
- There was no hazard identification process post blast and before production commenced.
- No risk management process applied for the change of pit width from 60 to 85 to 35 metres.

ICAM Analysis (RSHQ Report 20/03/2020)

Organisational Factors

- No risk management process applied for the inclusion of a presplit line on the echelon wall.
- Production pressures resulted in dozers commencing removal of material before excavators could effectively scale wall of hung-up material.
- Change of mine strip design to 35m from 85m lowered the blast cast height which made scaling walls of hung-up material difficult.
- Dozers continued to remove material in echelon wall area after it was identified that excavators could not reach the hung-up material.
- No blast effective analysis conducted before production commenced.
- Production was conducted on a continual roster with engineering personal only available Monday to Friday.
- The presence of the presplit on the echelon wal was not effectively communicated via any of the available communication tools.
- The blast was conducted over a weekend and the analysis of the blast by the technical services department was not communicate until Monday. As a result, production commenced before the hazard analysis was communicated.

ICAM Analysis (RSHQ Report 20/03/2020)

Organisational Factors

- Production based decision making.
- Historical evidence of the mine having repeat occurrences of not digging to design.
- Production Department does not have an approachable culture to identifying hazards.
- Production pressures gave way to hazard identification and mitigation.
- Management had an inadequate response to addressing issues raised with the Ground Control Management Plan.
- Management displayed a general disregard in the response to issues raised with the Ground Control Management Plan.
- Previous directives were closed out based on a letter provided by management stating that the Ground Control Management Plan had been reviewed and finalised.

Recommendations (RSHQ Alert No. 364)

- Ensure sufficient geotechnical data for safe pit design and modelling is collected, analysed, interpreted and communicated.
- Ensure the geotechnical risk management strategy includes rockfall modelling to determine appropriate exclusion zones, capable of containing any potential rockfall material within the exclusion zone.
- Ensure that a visual demarcation is placed along all exclusion zones. Examples being earth bund, witch's hats or fencing.
- Ensure a person with geotechnical competencies conducts scheduled geotechnical risk assessments of all pit walls in relation to stability.
- Review current controls to ensure risk to persons from geotechnical hazards is within acceptable limits and as low as reasonably achievable.
- Review their current geotechnical monitoring program and associated Trigger Action Response Plans (TARPs) to ensure that they are adequate and effective.
- Ensure adequate training programs are in place to enable all personnel to receive appropriate and regular training in geotechnical hazard awareness and have a clear understanding of the appropriate TARPs.
- Ensure the Safety and Health Management System contains a process that verifies that extraction is conducted to design. It should ensure regular inspections of mining areas are conducted.

Middlemount SHMS Improvements

- Successful transition to a compliant and effective SHMS that integrates risk management elements and practices to reduce and mitigate risk exposures, while incorporating organisational structure, responsibilities, planning activities, practices and resources for developing, implementing, maintaining and reviewing the effectiveness of the SHMS.
- Developed Critical Control Management Plan and Performance Standards for all Principal Hazards, with associated Critical Control Verification checklists.
- Established a Crisis Management and Emergency Response system supported by fully trained and competent Incident Management and Mines Rescue team members, as well as 24-hour rescue paramedics with industry best practice medical equipment and rescue gear.
- Reviewed and updated the contractor management plan and templates to assist in the effective safe onboarding and ongoing management of contractors.
- Rolled out a change management process across the operation to address all potential risk impacts associated with a significant change to business processes or procedures.
- Established a Safety Leadership Program to empower cultural change and drive compliance to standards including focused safety interactions and mandatory workplace inspections to target key serious injury and fatal risk hazards.