Investigation information release

Planning & Environment Resources Regulator

CAUSAL INVESTIGATION PRELIMINARY REPORT:

Unintended movement of conveyor boot end unit

- **Incident date**: 29 August 2017
- **Event**: Dangerous incident.
- **Location**: Ulan West Operations, near Mudgee, NSW

Overview

The NSW Resources Regulator is coordinating a causal investigation into an incident on 29 August 2017 in which seven workers sustained minor injuries during a conveyor extension in maingate 5 development panel at the Ulan West Operations underground coal mine. The purpose of the causal investigation is to enable the full understanding of the causes of this incident.

While the investigation is ongoing, inquiries to date have identified that:

- a software parameter of the dynamic move up (DMU) was disabled on installation, which allowed the DMU to advance while the panel belt loop take-up winch was not powered and this was not identified during the commissioning process
- during the conveyor belt extension on 29 August 2017, and due to an unrelated incident, power was lost to the conveyor drive head, winch and the DMU and the subsequent restoration of power did not restore power to the conveyor winch
- as a result, as the DMU was advancing inbye, an over-tensioning of the belt occurred, causing a failure of a linkage point between the DMU and the conveyor boot end, breaking large steel components.

This preliminary report is being issued at this early stage of the investigation in accordance with the regulator's causal investigation policy. A full investigation report will be published on the completion of the investigation.

The mine

Ulan West Operations is near Mudgee, NSW. Ulan West Operations operates one longwall panel (400 m wide) and three development units, of which one has a flexible conveyor train (FCT)/DMU to convey coal from the miner to the section conveyor.

The incident

At 12.36 pm on 29 August 2017, seven workers were conducting a planned conveyor belt extension in maingate development panel MG5. This process involved advancing the DMU that forms part of a system known as the 4 FCT. This system is used to transfer coal from a continuous miner to the panel conveyor. The DMU advancing process (part of a panel belt extension) includes reducing tension in the panel conveyor belt from its normal operating set-point, and isolating certain parts of the conveyor drive systems. The DMU is then advanced using hydraulic rams, which pulls the boot end inbye and pulls the belt from the conveyor storage unit (commonly known as a loop take-up) located at the conveyor drive head.

During the conveyor belt extension and due to an unrelated incident, power was lost to the conveyor drive head, winch and the DMU. The subsequent restoration of power did not restore power to the conveyor winch. As the DMU was advancing inbye, an over-tensioning of the belt occurred, causing a failure of a linkage point between the DMU and the conveyor boot end, breaking large steel components. The release of stored energy resulted in the boot end unit being dragged about 16 m by the belt, impacting on the installed conveyor structure and also the workers who were standing in the area. No-one was seriously injured, however, one worker suffered suspected head injuries and was taken to Mudgee Hospital for treatment. He was released later that evening.

Figure 1: Damaged structure outbye of the tail pulley frame where some of the workers were standing. *Photos supplied by the mine*.

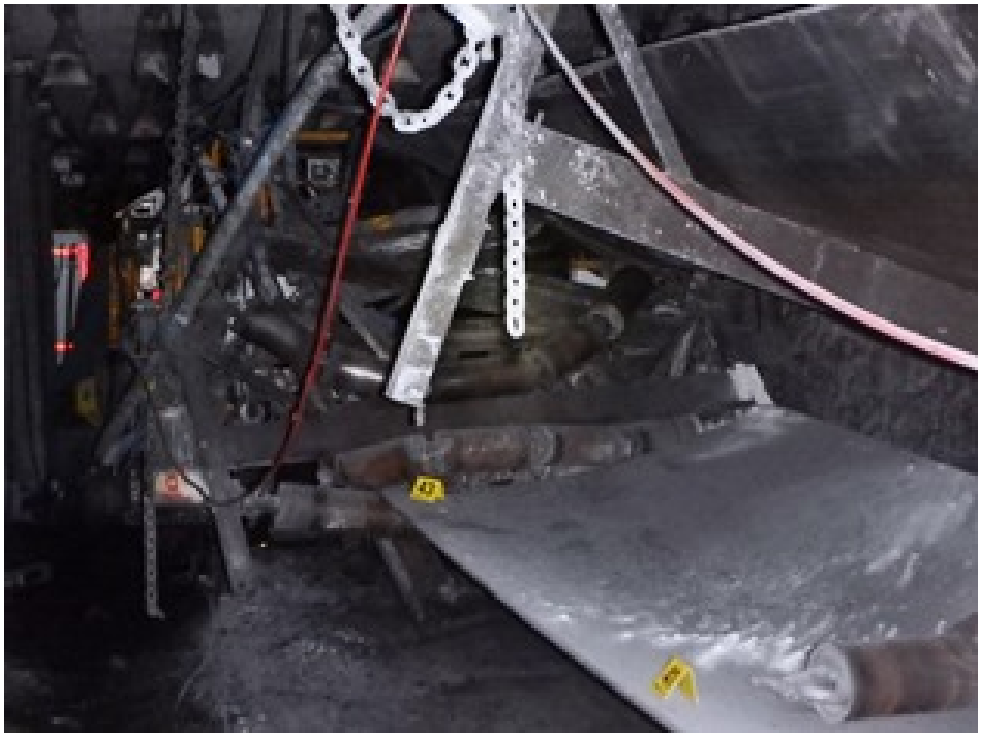


Figure 2: Failed connection hitch looking inbye at the DMU.

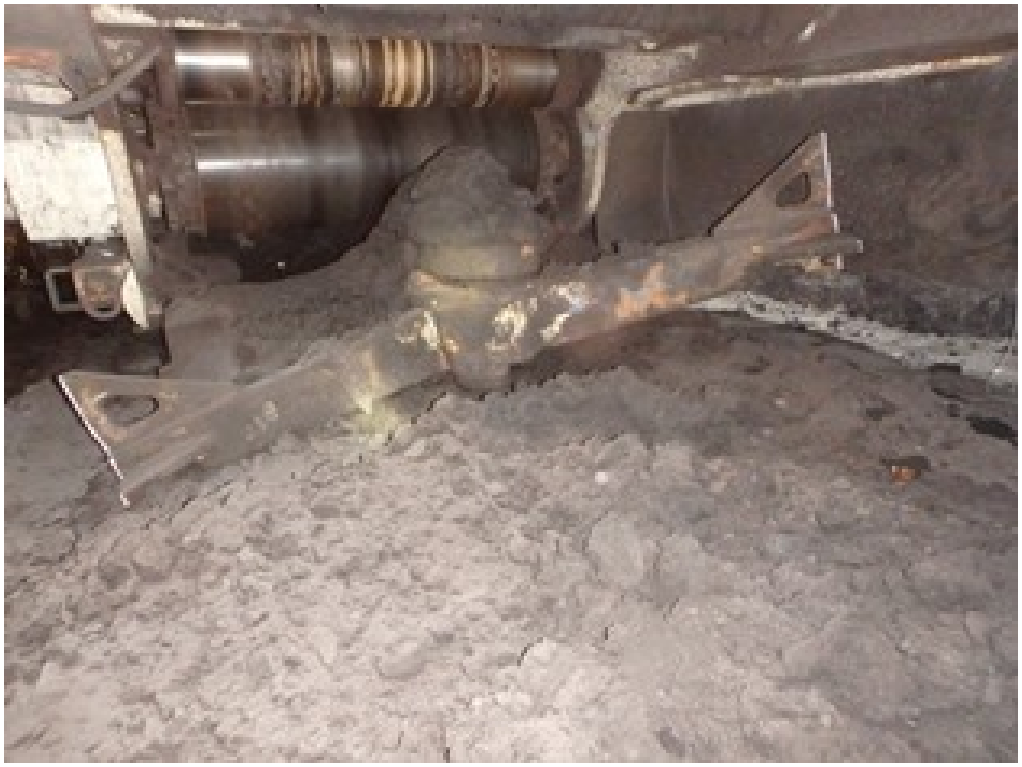
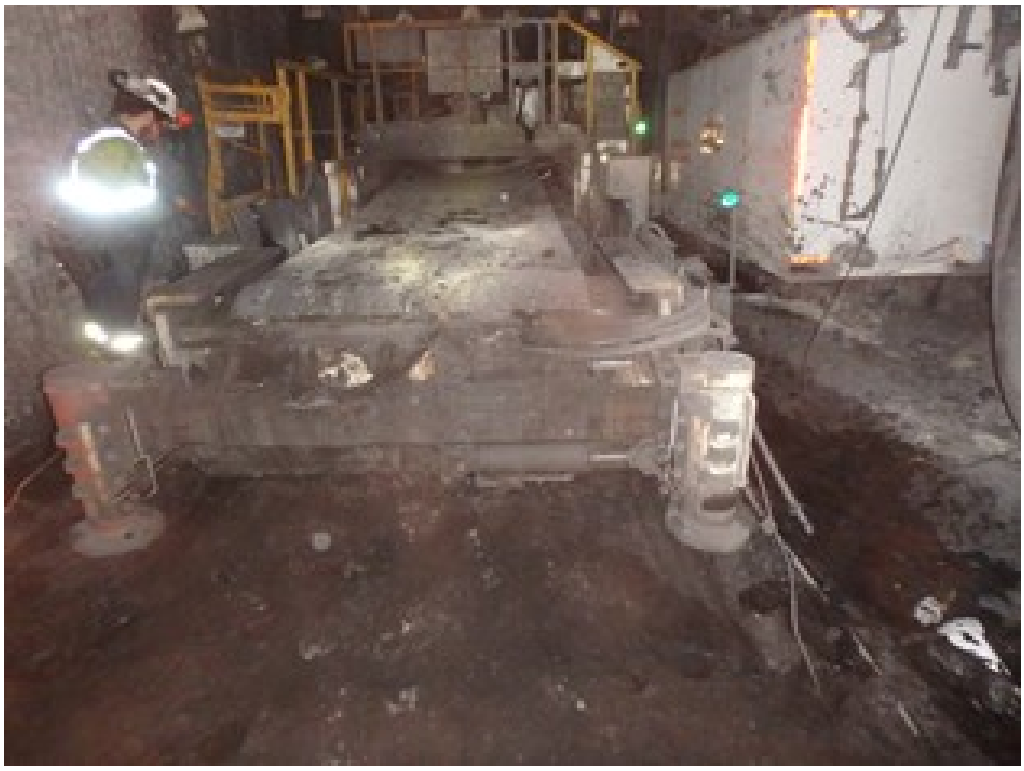


Figure 3: Failed connection hitch where it attaches to the side shift frame on the tail pulley frame.

Note: The distance between the tail pulley frame and the DMU was 16.4 m.



Background

The FCT and associated DMU at Ulan West Operations is in the development unit with a continuous miner cutting two headings linked by a cross cut drivage approximately every 100 m. The miner cuts the coal and the FCT/DMU transfers the coal using a belt system on the FCT and the DMU to deliver coal onto the panel conveyor belt. The FCT and DMU are approximately 250 m in length.

- The FCT/DMU was manufactured by Komatsu and placed into service at Ulan West Operations about May 2014.
- In partnership between the mine and the original equipment manufacturer (OEM), a design change was made to the FCT/DMU by the OEM in order to eliminate the conveyor belting rubbing the tail pulley steel framework, which was a potential fire risk.
- The design change was to replace the connection between the DMU and the tail pulley frame allowing for floor jacks and a side shift mechanism to be installed to line and level the tail pulley and boot end frame.
- The FCT/DMU was used in two previous gate roads (MG3 and MG4) and is now installed in the third gate road (MG5).
- On 20 July 2017, an over tension incident occurred due to the winch tripping on low oil. An initial investigation was undertaken by Ulan West, however, the corrective actions resulting from the investigation were still in the process of being completed at the time of the 29 August incident.
- During a scheduled section advance, the FCT/DMU was being advanced when over-tension in the belt caused a failure of the connection hitch between the DMU and the conveyor boot end unit.
- The boot end was dragged 16.4 m outbye by the belt causing damage to the conveyor structure.

The investigation

A causal investigation team comprising representatives from Ulan West Operations, Komatsu, worker representatives and the Resources Regulator was established to investigate and identify the causal factors, determine the effectiveness of the controls being used and to discover what factors contributed to the failure of controls. A prohibition notice was issued, stopping operation of the equipment involved other than for repair, inspection and testing, until it was assessed and any damage or defects were repaired.

The causal investigation team undertook an incident scene inspection. An incident cause analysis method (ICAM) was conducted and facilitated by an experienced ICAM facilitator. The ICAM team included the members of the causal investigation team and people with relevant knowledge and experience on the equipment design and operation of this equipment. The ICAM included a review of the timeline of events, a "five whys" analysis and consideration of people, the environment, equipment, process and the organisational factors.

The OEM developed a change in the design of the connection hitch on request from the mine. This provided the ability to move/steer and align the conveyor boot end frame, which allowed for greater control of the boot end to track the belt though the tail pulley to prevent the belting rubbing on the boot end structure. This also prevents coal spillage and build-up of coal in this area.

The investigation found that an interlock installed (by design) only allows the DMU to advance when the panel belt loop take-up winch is healthy. The parameter *'BeltAdvanceModeEnabled'* in the DMU control system was set to zero (0), which disables this interlock.

Investigations have also revealed a commissioning process was completed underground in July 2017 with one of the commissioning requirements being to verify that all parameters were correct. This was a single line item in the commissioning documentation, and was signed as completed. However, it has been determined that not all software parameters in the equipment were visible to all users, this being dependent on the level of password entered into the control system. This contributed to the interlock remaining disabled.

It has also been identified that the commissioning documentation did not include a specific test of the feature that stops the DMU advancing if the panel belt loop take-up winch and belt tension control is not in an operable condition.

A recently revised written procedure for the belt advance did contain administrative controls for belt over tension. However, workers performing this task had a poor understanding of this, which was also a contributing factor to this incident.

Contributing factors and incident timeline

Change design of connection	Latent condition main contributing factor	Contributing factor.	Trigger contributing factor	**Incident**
Mine and OEM change design of connection hitch to eliminate a hazard.	Software parameter incorrect for operation underground This eliminated four controls	Procedural issues. Further investigation required.	Loss of power to all equipment. Power restoration on to the DMU (inbye) No power restored to winch (outbye) Conveyor isolated and locked	DMU advanced increasing tension in belt as the winch was not powered until the connection hitch failed.

Note: If the software parameter was set correctly, the controls to protect from over tension would have stopped the DMU from advancing, even if the winch was faulty.

The mine operator has implemented interim controls until an engineering analysis can be conducted to install permanent controls. The following actions will be taken to identify additional engineering controls:

1. Engagement with the equipment manufacturer in a review of the design risk assessment.
2. Sending the failed tow hitch to a third party facility for failure analysis.
3. Sending the DMU failed boot end assembly and equipment to the OEM for assessment.
4. Using standard engineering methods to assess the structural integrity compared with the input force of the propulsion cylinders of the system and the functional safety of any interlocks.

The investigation will continue to examine the causal factors and any other controls that may have failed, including the systems of work and equipment associated with the incident. This may include a human and organisational factors analysis.

Recommendations

The Resources Regulator recommends the following:

1. Check that all software parameters of equipment are set to the correct values and verify their operation.
2. Review the operational risk assessment for all FCT/DMU operations.
3. Recommission the DMU belt system interface and test the logic with the belt system to verify that the DMU will not advance with the correct parameter setting.
4. Ensure a winch observer is at the winch whenever the DMU is to be advanced. An emergency stop facility should be at the winch to remove power from the conveyor, winch and DMU. A trigger action response plan (TARP) should be developed to identify actions required by the winch observer including the requirement to remove power from the conveyor, winch and DMU if a red TARP condition exists at the winch.
5. Provide positive communications between the winch observer and the boot end to confirm that the winch tensions are operating within the set tension limits.
6. Update safe work procedures for a belt extension using the DMU and monorail to include a verification step to ensure the parameter is correct, to record the reading and to verify its operation before any belt advance.
7. Train workers in the updated procedures and controls for the belt extension using the DMU.
8. Review the implementation of interim controls to ensure they are effective. The review should include worker representative and OEM participation.
9. Review software password management to prevent unintended access and changes in the software parameters.

About this information release

The Resources Regulator has issued this information release to draw attention to the occurrence of an incident in the mining industry. Investigations are ongoing and further information may be published as it becomes available.

The information contained in this publication is based on knowledge and understanding at the time of writing. However, because of advances in knowledge, users are reminded of the need to ensure that the information upon which they rely is up to date and to check the currency of the information with the appropriate officer of the Department of Planning and Environment or the user's independent adviser.

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