

INVESTIGATION INFORMATION RELEASE

DATE: 24 June 2019

Collision between semi-autonomous dozer and manned excavator

Incident date: 27 May 2019

Location: Wilpinjong Coal Mine, Mudgee, NSW

Overview

A collision occurred between a Caterpillar D11T dozer operating semi-autonomously and a manned Hitachi EX1200 hydraulic excavator at 13:40 on Monday 27 May 2019. The excavator operator was scaling a section of a highwall in the operating area of the semi-autonomous dozer fleet. The excavator travelled into an active slot, in the path of a dozer working in semi-autonomous mode, while the dozer was reversing to commence the next programmed push. When the dozer contacted the rear of the excavator, it pushed the excavator approximately 1.5 metres sideways and then began to spin its tracks. After five seconds the dozer's semi-autonomous system identified that it had experienced track slip and stopped tramming as programmed.

Figure 1 & 2 - Incident scene immediately following the incident



The mine

Wilpinjong Coal Mine is owned and operated by Peabody Energy. It is a thermal coal operation mining the Ulan seam, located about 40 kilometres north east of Mudgee. The mine uses bulk dozing methods to remove overburden. Wilpinjong has implemented a semi-autonomous dozer program to improve the efficiency of this process.

Figure 3- The SATS operating area, taken on the morning of the incident



The semi-autonomous system

When first implemented in 2015, the semi-autonomous tractor system (SATS) consisted of a single Caterpillar D11T dozer. Operations were increased to three dozers in 2017 and a fourth added in 2018. The SATS enabled dozers can be operated manually - with an operator on board, under remote control operation, or in a semi-autonomous state by an operator in the control station.

The SATS dozers are controlled by an operator in the control station, which is installed in a caravan. The control station replicates the operator controls in a Cat D11T dozer, with the addition of several monitors and keyboards. Each dozer is fitted with four cameras, three forward facing, one rear facing. When a dozer is selected by the operator, a screen in front of the operator displays the four cameras. A small side panel shows two camera views for each of the other three dozers, refer to figure 5. At any point, the operator can swap between dozers. When in semi-autonomous mode, the dozers can only conduct pushing

Figure 4 - The SATS control station



operations in a designated slot within the avoidance zone. The strip being mined included an established avoidance zone that was approximately 300 metres long, 135 metres wide and consisting of 30 slots.

Due to the operating method, the mining process requires an excavator to clean the back of the bench against the highwall. This is required as this section of material is where the dozers reverse before commencing a push.

The incident

On Monday 27 May 2019, a mine worker was assigned to EX1014, a Hitachi EX1200 excavator. The initial task for the day was to clean the back of the bench in the dozer push area. This activity commenced in the northern section of the avoidance zone in the operating area. One operator was assigned to the control station, operating three dozers. The fourth dozer was undergoing maintenance work. A trainer and trainee operator were in the control centre conducting training.

Early in the shift, EX1014 had scaled the northern highwall and thrown the material behind, forming a windrow. Mid-morning, a mining supervisor instructed the operator of EX1014 to leave the dozer push area and establish an edge windrow on the bench above. At the completion of this task, the operator had a crib break. At the end of his break, a discussion was held between the operator of EX1014 and the SATS operator. They spoke about the work that needed to be completed during the rest of the shift but did not discuss the locations of other SATS dozers in the avoidance zone.

Wilpinjong operating procedures require a bund to be maintained, between manual and autonomous work areas within the avoidance zone, to indicate to workers that they are proceeding into the active autonomous work area. At the time of the incident this bund was not in place.

EX1014 proceeded back into the SATS avoidance zone from the north, scaling the highwall toward the south. The windrow previously formed stopped prior to slot 16 where dozer 2003 was operating in semi-autonomous mode.

Immediately prior to the incident, the SATS operator was operating dozer 2010 that had paused because it required operator input. As EX1014 proceeded past the end of the windrow and continued scaling the highwall, dozer 2003 had completed a push and commenced reversing. The dozer was travelling in second gear at approximately 7 kilometres/hour. As the ripper box contacted the rear of EX1014, it continued to drive, pushing EX1014 sideways approximately 1.5 metres. At this point, the dozer lost traction. After five seconds of tracks slipping, SATS alarmed and stopped dozer 2003. From initial contact to dozer 2003 stopping took approximately 14 seconds.

As contact was made between the machines, the operator of EX1014 attempted to call the SATS operator on the radio to stop the dozer. This was unsuccessful, due to radio channel selection and radio traffic. The excavator operator had no other means to stop the semi-autonomous dozer. The operator was not injured.

The mine initiated emergency procedures. The operator ensured the excavator operator was not injured and notified the NSW Resources Regulator of the incident. The mine assisted the operator in safely exiting the excavator.

Figure 5 - screenshot of SATS operator monitor prior to incident



Causal Investigation

A causal investigation team, comprising representatives from the mine operator, Peabody Energy - Wilpinjong Coal Mine, worker representatives and the NSW Resources Regulator, was established on 7 June 2019 to investigate the circumstances that led to the collision between a manned excavator and semi-autonomous dozer. The investigation has commenced and is ongoing.

The investigation will consider any potential deficiencies in procedures, equipment and training that may have contributed to the exposure of hazards to workers or other people. The scope of the causal investigation includes, but is not limited to:

- Collision avoidance systems fitted to plant operating within the SATS avoidance zone. This was not fitted to EX1014
- The suitability of controls to limit interaction between semi-autonomous and manned equipment
- Effectiveness of controls when manned vehicles enter the semi-autonomous work zone
- Monitoring of workers conducting semi-autonomous and tele-remote operations of dozers and workers within the autonomous control zone.

The mine completed an Incident Cause Analysis Method (ICAM) which has formed the basis of the investigation. Additional matters investigated will include:

- The causal circumstances of the incident, including an incident timeline
- Identification and maintenance of controls
- Human and organisational factors
- The regulatory environment in which the incident occurred
- Recommendations for the mining industry to prevent a similar incident reoccurring
- Recommendations for the NSW Resources Regulator to assist with better regulation.

The causal investigation team may also consider:

- Previous incidents of a similar nature
- Reasonably practicable control measures
- What prevented the risk manifesting as a serious injury or fatality
- Any other factors, where appropriate.

The NSW Resources Regulator will not be considering further enforcement action in relation to this incident, unless a significant breach of work health and safety legislation is observed, where:

- reckless conduct is observed or
- false or misleading information is provided about the incident.

An investigation report will be prepared at the completion of the investigation.

Recommendations

Analysis of the causal factors involved in this incident are continuing. Mine and petroleum site operators are reminded of their duty to identify hazards and manage risks to health and safety in accordance with the provisions of the Work Health and Safety Act 2011 and Work Health and Safety (Mines and Petroleum Sites) Act 2013 and regulations.

The circumstances of this incident should prompt mine operators to review their safety management systems, focusing on:

- Reviewing controls in place to prevent workers inadvertently entering an area where automated equipment is operating

- Confirming the hierarchy of controls have been adequately used when developing controls to manage interactions between manned equipment that interacts with semi-autonomous and tele-remote equipment
- Having a suitable physical barrier in place relevant to the equipment being operated, when segregation is required between manned equipment and semi-autonomous and tele-remote equipment
- Scheduling workplace inspections by supervisors of workers operating adjacent to or within semi-autonomous, autonomous and tele-remote operation zones.

About this information release

The NSW Resources Regulator has issued this information to draw attention to the occurrence of a serious incident in the mining industry. Further information may be published as it becomes available.

Visit our [website](#) to:

- learn more about our work on causal investigations and emergency response
- view our publications on other causal investigations.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (June 2019). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the NSW Department of Planning and Environment or the user's independent advisor.

DOCUMENT CONTROL

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