

# SAFETY BULLETIN

DATE: APRIL 2022

## Crane incidents on the rise

This safety bulletin provides safety advice for the NSW mining industry.

### Issue

A rise in the number of incidents involving cranes has prompted the NSW Resources Regulator to review recent events in the NSW mining industry.

Over the past 12 months, there were nine incidents involving cranes with the three most recent incidents occurring within a four-week period. The incidents involved both mobile and gantry cranes with a range of causes or contributing factors, without a common theme.

### Incident 1

A 25 tonne pick and carry articulated mobile crane (see figure 1) was being used to relocate a belt winder that weighed approximately seven tonnes. During the relocation, the crane was articulated and slowly rolled onto its side. The operator was uninjured and was able to exit the crane.

*Figure 1 – Articulated mobile crane overturned - cause still under investigation.*



## Analysis

A lift permit and safe work method statement were in place for the lifting operation, which included supervision and spotters. Environmental conditions were good, and the ground was relatively flat. Witnesses said the belt winder was rigged level when it was lifted. The crane reversed approximately five metres before articulating and then overturning. Initial investigation found the crane was not overloaded when it was positioned straight but became overloaded when it was articulated to 21 degrees. The mine operator reported that the overload alarm activated but was ignored.

## Incident 2

A dredge wheel excavator arm was being loaded onto a heavy transport trailer using two 150 tonne cranes. The operation involved lifting the arm and reversing the trailer under the load. As the weight of the arm transferred to the trailer, rear wheels of the prime mover became unweighted. The truck and trailer then started to roll forward as the rear wheels of the prime mover were the only wheels with a brake applied.

The driver got into the truck and applied the brakes to the trailer after it had rolled approximately three metres. There were no injuries.

*Figure 2 - Truck moved on placement of load*



## Analysis

Complex lift plans and critical lift permits were in place for the lifting operation. Site protocols for critical control checks and system verification were also performed and were supported by pre-task risk assessment tools.

Despite these processes, and the lift itself being undertaken successfully, the trailer supplied by the trucking contractor was different to the trailer originally specified for the job. It suited the gross mass of the dredge wheel excavator arm being transported but not its physical size or mass distribution characteristics.

Positioning the support frames on the trailer was left to the experience of the truck operator. Because the centre of gravity was so far rearward on the trailer, the upward force at the king pin lifted the unweighted rear wheels of the truck, which were the only wheels with an applied brake.

Furthermore, due to the hydraulic jacking feature of the trailer, it was common practice to not engage the trailer brakes during loading. Commonly, the trailer is raised to accept the load rather than the load being placed on to the trailer with the use of cranes. The wheels must be free to rotate during the jacking operation to avoid brake damage.

## Incident 3

A 20 tonne overhead crane was being used to lift a motor stator weighing 18.3 tonne up to the motor room of a powered winding system. Approximately 10 metres off the ground the crane stopped without input from the operator and the load descended, landing on the transport frame it was lifted from. The crane brake that applied automatically failed to hold the load but did slow its descent.

*Figure 3 - Motor stator (left) - restrained after fall and brake disc (right)*



## Analysis

Inspections by the crane subcontractor in the month before the incident found the brake was in good condition. Damage to the brake was therefore attributed to have occurred as a result of the incident. Visual inspections confirmed no damage or failure of the crane electric motor, gearbox, shafts, drum or ropes.

Post-incident load testing with a 15 tonne load tripped mid lift and the load dropped a few centimetres. The raise full current limit switch (CRL) was found to have inadvertently activated. Analysis of the circuit shows uncoupling of two of the three phases when the CRL trips. The remaining single phase caused the motor to reverse and prevented the brake from applying. The drum brake was unable to stop the load due to the momentum developed by the descending load and the time delay in brake application.

Ultimately the root cause was attributed to the rope pressing against the rings of the CRL and causing it to activate prematurely. The electrical circuit was upgraded in 2013, however this limit switch was not replaced.

Following the incident, the electrical circuit was altered to include three phase isolation when the CRL trips, an additional brake contact was introduced to ensure faster brake application, a new start button inhibits auto-start after reset of the E-Stop and the mechanical assembly of the CRL altered to prevent inadvertent activation.

## Recommendations

When performing tasks involving cranes and in addition to existing practices, mine operators and crane contractors should consider:

- which crane type is best suited for the task rather than using what is readily available (such as pick-and-carry crane, forklift, mobile crane).
- introduction to site processes include:
  - verification of accuracy of mass scales in cranes
  - instruments such as inclinometers and speedometers are operational
  - operator alarms and warning systems are operational.
- how to minimise manoeuvring, after the load has been lifted, particularly on grades
- information regarding the limitations of use from the crane original equipment manufacturer (OEM) is readily available to operators. Limitations such as, but not limited to
  - maximum mass or load, and circumstances which those maximums apply

- maximum fore/aft and lateral inclined operating angles
- maximum load when fully articulated
- maximum tramming or operating speeds when loaded and unloaded
- complex lift plans to trigger (where appropriate) engineered load plans for the receiving truck or trailer to include analysis and checklists for:
  - specification of truck or trailer based on mass, dimensions, and weight distribution of the load
  - confirmation the truck or trailer meets specification
  - specification of rated load supports (frames under load)
  - calculated King-pin load within acceptable range
  - maximum axle or tyre loads are not exceeded for transport load, particularly for non-uniformly distributed loads
  - a load restraint plan for braking, acceleration, and cornering loads
  - brake or wheel chock requirements during the loading operation
  - if the driver should remain at vehicle controls during loading where safe to do so.
- stopping and reassessing crane and transportation tasks when changes occur to ensure any new hazards are identified and controlled. Changes may occur to lift plans, transport plans, equipment, the environment and people involved.
- when upgrading crane equipment, the use of modern techniques such as DFMEA, functional safety or similar processes to improve reliability of crane control systems.

Additionally, crane operators should:

- always use equipment within operational limits
- be able to competently determine maximum load limits for the intended use scenario
- obey warning alarms and never bypass or override safety systems
- report suspected faulty alarms, the cause to be investigated and repaired if required
- advise their supervisor of any fitness for work concerns which may affect their ability to focus on the task and operate equipment. Fitness for work may be affected by fatigue, stress from work, personal circumstances and alcohol and other drugs.

Note: Alternatively, if the supervisor is concerned about an operator's fitness for work, discussions should occur and controls implemented as per the mines' health control plan.

**NOTE:** Please ensure all relevant people in your organisation receive a copy of this safety bulletin and are informed of its content and recommendations. This safety bulletin should be processed in a systematic manner through the mine's information and communication process. It should also be placed on the mine's common area, such as your notice board where appropriate.

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## Other relevant resources

[SA09-14 Crane A-frame mast falls on rigger](#)

[SA07-07 Uncontrolled free fall of a crane hook](#)

[SA04-06 Crane dogger killed unloading trailer – Updated](#)

[QLD Mines safety alert no. 263 - Non-slewing articulated mobile cranes tipping](#)

[Investigation report - Serious injury at Springvale Colliery 5 February 2019 \(PDF, 1.22 MB\)](#)

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