# Investigation

# ICAM Report

## Missing and Loose Wheel Nuts on Cat 785D Rear Dump Truck (RD1)

**Location:**

**Date:**

| Investigation Team | |
|---|---|
| **Name** | **Position** |
| | |
| | |
| | |
| | |
| | |

# Contents of Report

## 1.1 Incident Description:

Near Miss – Missing and loose wheel nuts on Position 3 wheel of Cat 785D Rear Dump Truck (RD1).

## 1.2 Location Details

| | |
|---|---|
| **Location:** | |
| **Time:** | 12:00pm |
| **Date:** | |

## 1.3 Details of Injured Person

| | |
|---|---|
| **Name:** | No Injuries |
| **Company:** | n/a |
| **Injuries Sustained:** | n/a |
| **Medical Treatment:** | n/a |

## 1.4 Details of Damage/Impact

| | |
|---|---|
| **Damage to Equipment:** | No damage |
| **Environmental Impact:** | No environmental impact |

## 1.5 Risk Rating

| | |
|---|---|
| **Actual Consequence Level:** | Near miss – no consequence |
| **Actual Likelihood Level:** | n/a |
| **Potential Consequence Level:** | Moderate <$100k damage |
| **Potential Likelihood Level:** | Possible |

## 1.6 Pre Incident

The rear dump truck (RD1) had been operational for approximately 18 hours after delivery to the

## 1.7 Incident

On 4th June 2013, whilst repairing a loose/leaking valve stem on Position three wheel of a Cat 785D rear dump truck, fitters noted movement in the outer tyre rim of Position three wheel. Further investigation on the 5/6/13, which included removal of the tyre, identified 30 of the 45 nuts which are used to secure the adapter plate were missing. The remainder were in place however were down the thread and close to coming off.

## 1.8 Post Incident

All tru were stood down and all wheel nuts were checked / re-tensioned.
No other vehicles had loose wheel nuts.

## 1.9 Photographs

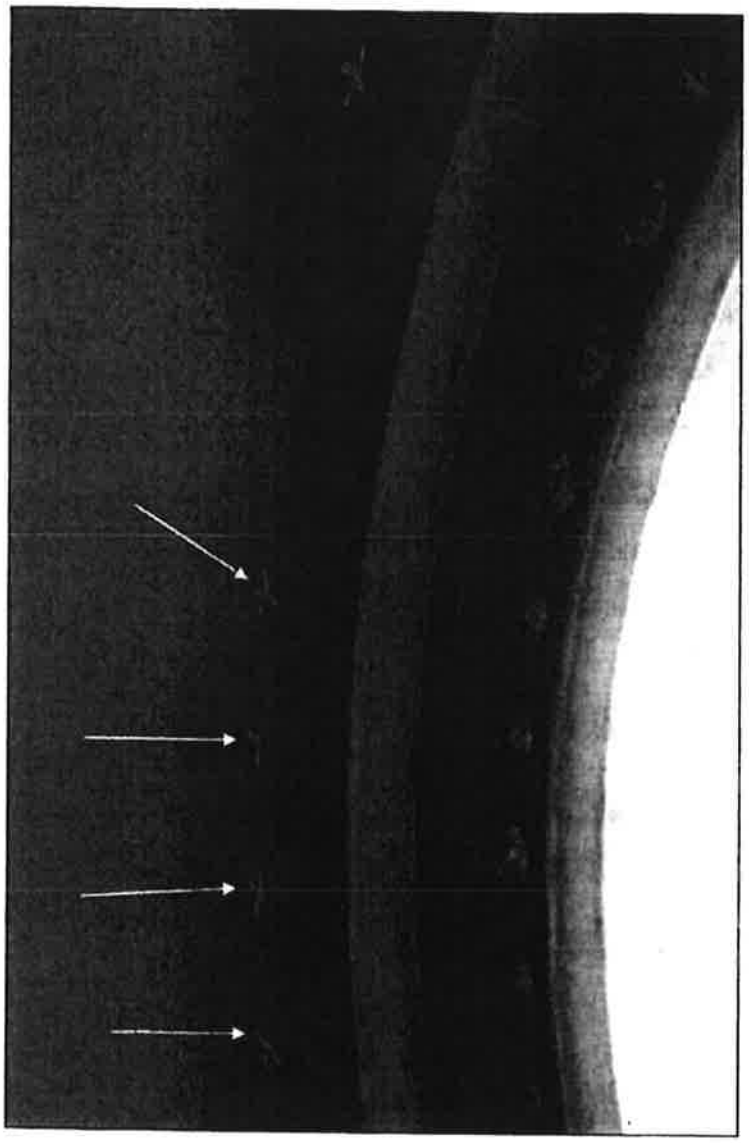


Figure 1. Studs had marked to indicate they had been tensioned at assembly.

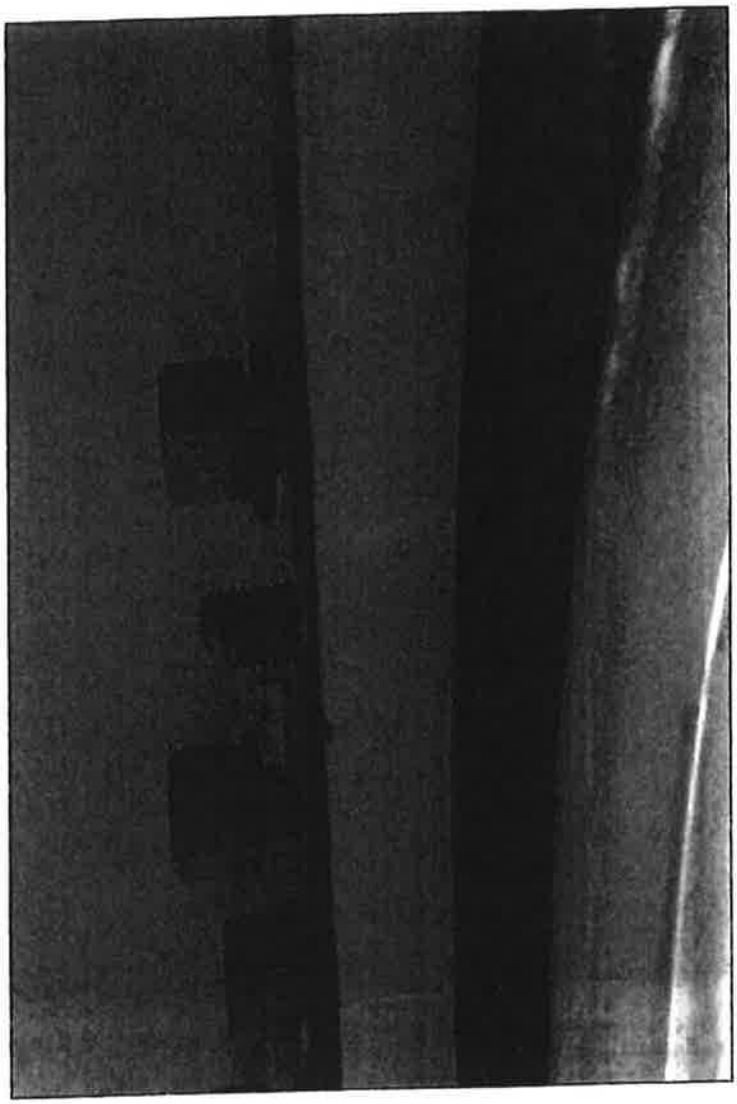


Figure 2. Remaining Wheel Nuts -- most were close to coming off.

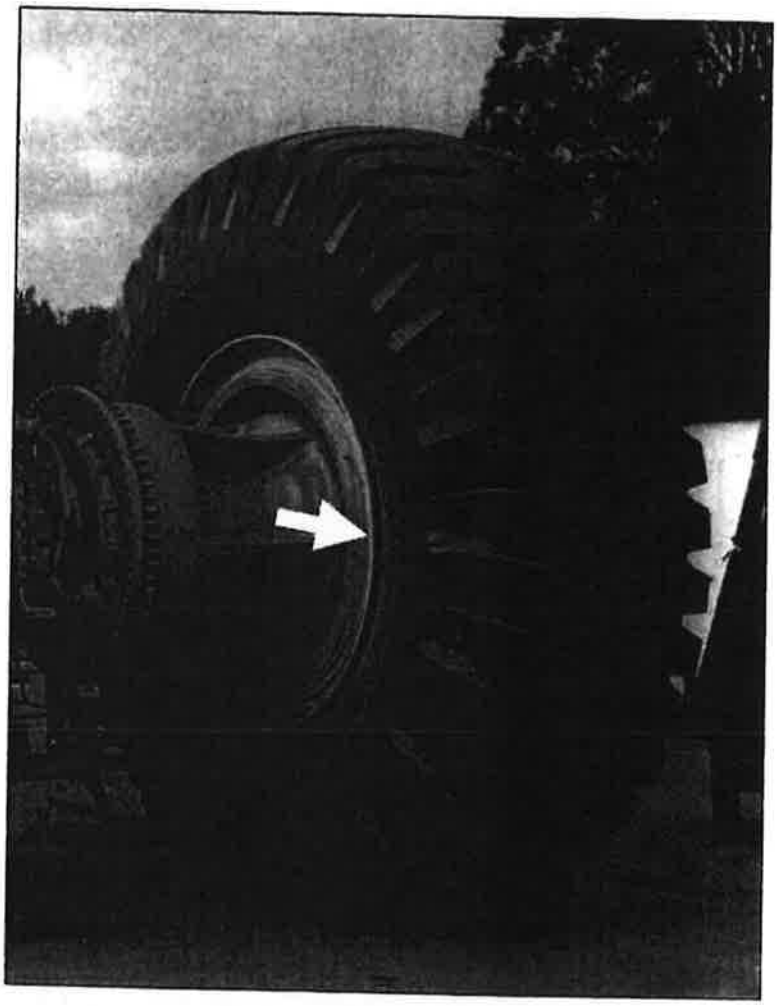
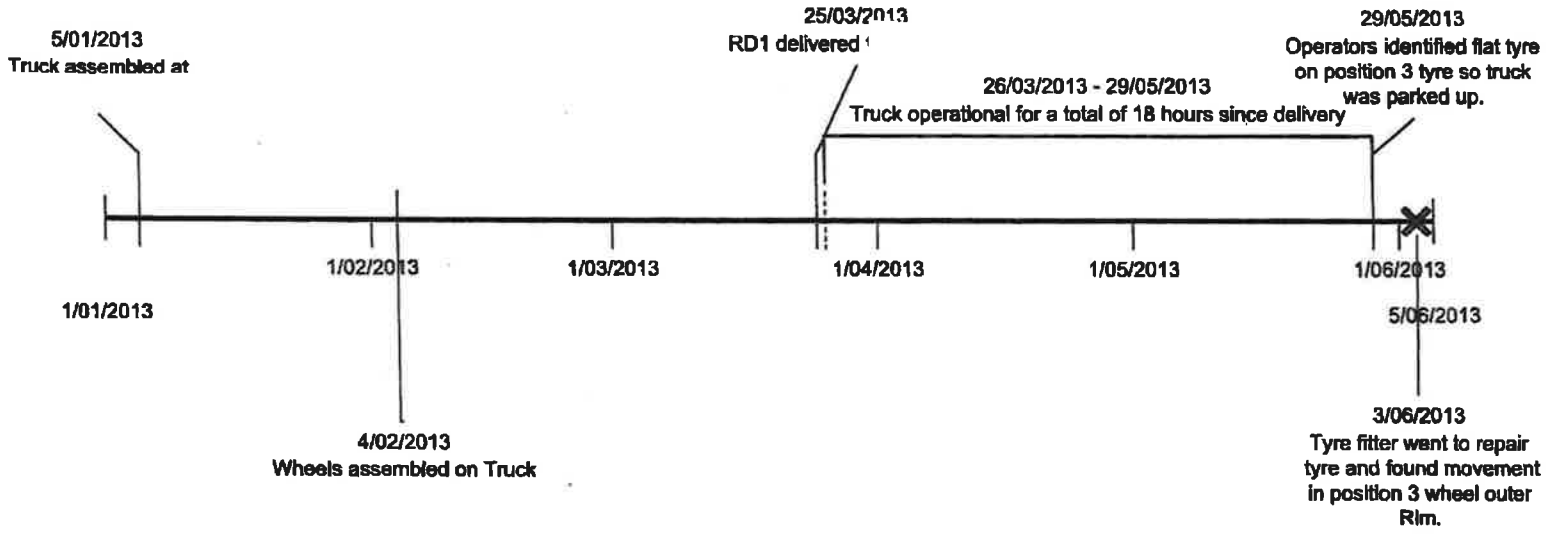


Figure 3. Disassembled dump truck with Position 3 wheel only in place. Adaptor ring had missing and loose wheel nuts

## 1.10 Timeline of Incident



# 2.0 Key Findings

The key findings outline why the incident occurred and the contributing factors deduced from the investigation have been categorised using the Incident Cause Analysis Method (ICAM). The ICAM analysis chart is shown as an appendix in Appendix C of this report.

## 2.1 Root Cause

Failure to re-torque the wheel nuts following fitment.

## 2.2 Contributing Factors

Based on the evidence to hand, the Investigation Team believes the following were the main contributing factors to the incident:

### 2.2.1 Absent or Failed Defenses

1. **Wheel nuts were not re-torqued after fitment**

Rear Dump truck (RD1) had been operational for approximately 18 hours following delivery to the site, however the tension on the wheel nuts were not checked nor were they re-torqued after a period of operation.

2. **No documented procedure for re-torqueing wheel nuts following fitment**

A documented procedure for re-torqueing following fitment was not in place at

3. **Potential that torque settings on torque tool were incorrect or correct tension was applied during assembly.**

Although this couldn't be verified post-incident, this was considered to be a possible contributing factor. It is possible that the settings on the torque tool were incorrect or the fitter failed to apply the correct tension. The tension of the nuts is not verified by the fitter or by the Supervisor during his sign off

### 2.2.2 Individual or Team Actions

1. **Failure of the personnel to recognise the requirement to re-torque the wheel nuts.**

The personnel knew the truck was new and had only recently been assembled when it was delivered to the site, however they failed to recognise the standard requirement of re-torqueing the wheel nuts at a nominated interval following fitment.

### 2.2.3 Task or Environmental Condition

1. **Not a common task for Operation**

locations, mobile equipment is typically only operated for testing and maintenance purposes. The s as no other in an operational capacity.

Therefore the requirement to re-torque wheel nuts at a nominated interval following fitment is not normally a task that is carried out.

The site has only been in operation since and does not have regular deliveries of new trucks.

2. **Truck had been operational for 18 hours post-delivery.**

Common practice at mines is to operate the truck with at least two loads then re-torque the wheel nuts. The truck had been operated for approximately 18 hours after it was delivered to site, exceeding the required period for re-torque.

3. **This is the only truck in operation at that had loose wheel nuts.**

Following discovery of the loose wheel nuts, all trucks were stood down to investigate if any other trucks had the same issue. A 993K wheel loader also had a loose wheel nut.

### 2.2.4 Organisational Factors

1. **No documented procedures for re-torqueing wheel nuts following fitment.**

Re-torque following delivery of new trucks to customer locations is common practice by the mines. The requirement to re-torque is not normally included in customer assembly notes as every site has different requirements in their Standard Operating Procedures.

2. **Maintenance system does not flag the re-torque process to be undertaken.**

The maintenance system failed to flag this requirement.

3. **Training and Competency**
   - **No competency assessment for fitting of wheels**
   - **Training on torque tools is informal**

Incorrect tensioning of the nuts was investigated as a contributing factor to this incident, although this cannot be proven. Discussion then ensued on competencies required for personnel fitting wheels and the use of torque tools. The training process for using torque tools is an informal process where employees are shown the safe operation of such tools. The investigation team determined that there was no formal verification of competence to conduct this task or to use the tools involved in conducting the task.

## 3.0 Recommendations from Contributing Factors

### 3.1 Safety Alert Communication

A safety alert will be distributed across to communicate the incident outcomes and learnings.

Consideration will also be made by to distribute recommendations for re-torqueing wheel nuts following fitment.

### 3.2 Management Review of the Investigation Report

The management of should formally review the investigation report for completeness, quality of the investigation and to endorse the recommended corrective actions.

### 3.3 Distribution

To maximise the preventative potential of the investigation report, the findings and conclusions of the report should be distributed as widely as practicable internally within This will be completed by a Safety Alert via 3.1 above.

### 3.4 Implementation of Corrective Actions

The recommendations will be formally presented to the Responsible Line Manager for discussion and setting of corrective actions.

An action plan and time frame will be agreed and endorsed by the appropriate level of management. An action plan is attached in section six of this report. All corrective actions will be entered into the SQM system as an associated action item against this incident. This will allow for easy monitoring of planned versus actual progress on corrective actions.

### 3.5 Implementation Monitoring

The completion of corrective actions must be documented and communicated by the Responsible Personnel and in turn to the Health & Safety Advisor. Where corrective actions have not been fully implemented, on-going monitoring should be maintained until implementation is complete.

### 3.6 Document Archival

Investigative data and reports shall be archived in accordance with site and regulatory guidelines.

## 4.0 Observations while conducting the investigation

The investigation concluded the following observations which may or may not have been contributory factors to the incident and may need to be addressed:

- The pre-start checks are not documented.

## 5.0 Positive Observations during the Investigation

The investigation concluded that the following observations have positively contributed to our investigation:

## 6.1 Recommendations from Contributing Factors - Corrective Action Plan

| Item Ref | Recommendation | Corrective Action | Responsible Department and Person | Completion Date | Sign Off |
|---|---|---|---|---|---|
| 1 | Procedure | Develop procedure for Tyre, Rim and Wheel Management at site. | | 30/06/13 | |
| 2 | Maintenance | Maintenance management system to capture requirement to re-torque wheels after delivery | | 30/06/13 | |
| 3 | Training | Develop process for capturing training / familiarisation conducted on Tyres and Rims. | | 30/09/13 | |
| 4 | Competency | Develop sign off process for ensuring competence on operating torque tools. | | 30/09/13 | |
| 5 | Pre-starts | Develop documented / electronic pre-start process for trainees to utilise. | | 31/07/13 | |
| 6 | Safety Alert | Develop Safety Alert | | 30/06/13 | |
| | | | | | |

Line Manager's Close out of Incident – **All corrective actions have been completed, where corrective actions have not been fully implemented, the followings measures have been put in place to ensure ongoing monitoring until implementation is complete.**

| | | |
|---|---|---|
| **Name:** ..... | **Signature:** ..... | **Date:** ..... |

### 5.1 Truck fleet was stood down to check other wheels

The truck fleet at was stood down and a check was conducted on the other wheels to ensure a similar issue didn't exist. This was a worthwhile exercise as a single wheel nut was found loose on a Cat 993K Wheel loader.

## 6.0 Significant Learnings

The investigation has raised a key learning which has been covered in the body of the report. The significant learning for

- The importance of checking wheel nut torque at a pre-defined period following the fitment of wheels on haul trucks used in an operational environment.

# Appendix A – 'Five Whys'

| Date | Event | Why | Why | Why | Why |
|---|---|---|---|---|---|
| 2013 | Truck Assembled at | is the location for assembly of equipment | Designated location | Team dedicated to Equipment Assembly. | |
| 04/02/13 | Wheels and wheel nuts installed as part of assembly | Assembly requirement | | | |
| 04/02/13 | Wheel nuts torqued by fitter, checklist completed and signed off. Approved by Supervisor. | To ensure vital safety requirements of the wheel are completed. | To ensure wheel is fitted correctly. | So wheel doesn't fall off | |
| 25/03/13 | Truck was delivered to with wheels on. | Transportation of Cat 785D trucks can be done with wheels on. | | | |
| 25/03/13 to 29/05/13 | Following delivery to site, truck had been operational for approximately 18 hours. No identified issues with wheels. | Training requirement for trainee operators. | Pre-start checks did not identify loose / missing wheel nuts | Would not have seen them due to location (inside) | |
| 29/05/13 | Operators identified flat position 4 tyre so parked the vehicle up. | Unknown cause of flat tyre. | | | |
| 04/06/13 | Truck parked up until 4/6/13. | Awaiting tyre handler | No tyre handlers a | Assembly of wheels and tyre work is not part of the operation. | |
| 04/06/13 | Tyre fitter went to repair tyre | To get truck operational again | To continue training | | |
| 04/06/13 | Fitters identified movement in outer rim of position 3 tyre. | Wheel nuts were missing on 30 of 45 studs and the remainder were loose. | Wheel had not been re-torqued after fitment of wheel. | Fa identify requirement to retorque. | No formalised procedure for the task. |

## 7.0 Report Sign Off

To maximise the preventative potential of the investigation report, the findings and conclusions of the report should be distributed to the various people involved in the incident and as widely as practicable.

The completion of corrective actions must be documented and communicated by the Responsible Personnel. Where corrective actions have not been fully implemented, ongoing monitoring should be maintained until implementation is complete.

| **Feedback to the Involved person(s) and comments** | | |
|---|---|---|
| | | |
| Name: ..... | Signature: ..... | Date: 18-6-13 |
| **Feedback to the Involved person(s) Supervisor(s) and comments** | | |
| | | |
| Name: ..... | Signatur | Date: 18-6-13 |
| **Line Manager's acceptance of findings and comments** | | |
| | | |
| Name | Signature: ..... | Date: 18.6.2013 |
| **Health & Safety Regional /General Manager acceptance of findings and comments** | | |
| | | |
| Name: ..... | Signature: ..... | Date: 19/6/13 |
| **General/Executive Manager's acceptance of findings and comments** | | |
| I agree with the findings above. | | |
| Name: ..... | Signature: ..... | Date 20/6/13. |

| | | | | |
|---|---|---|---|---|
| | Nuts were marked with white cross, indicating that the nuts had been tensioned. | | Not a common task for | Service letters get issued to relevant personnel on site |
| | Approximate hours of RD1 on the 29/06/13 were 26 hours, 18 since delivery. | | modelled o procedures procedures and are used for operational tasks only i.e. equipment operation. | |
| | Truck was brand new. | | Wheel nuts may have come off over a number of shifts, but visual inspections would not have identified the inner wheel nuts. | |
| | A single wheel nut was also found loose on the 993K Wheel loader. | | Servicing set up so that servicing is highlighted 50 hours prior. | |
| | Can't very that the tension was appropriate at assembly. | | | |
| | Trucks are operated at maximum 40km/hr | | | |
| | Reduced tonnage operation | | | |

# Appendix B – PEEPO Analysis

| People | Equipment | Environment | Procedures | Organisation |
|---|---|---|---|---|
| No competency assessment for tyre fitting | OEM approved wheel nuts were used. | Operating environment was not harsh | Nuts were torqued by fitter and signed off by supervisor prior to truck going into service. | No formalised procedures for Tyre, Rim and Wheel tasks. |
| Tensioned and signed off b and approved by Equipment Assembly **when truck was assembled.**. | Nuts and studs were in good condition (brand new). No paint or material left on threads. Clean threads. | Location was | do not have a re-torque procedure following fitment of wheels.<br>Nuts were not re-torqued. | Procedures for assembly were followed. |
| Field service Staff have little to no experience on mining equipment as is predominantly a construction and quarrying branch. | Cannot verify if torque settings were correct on torque tool. | Dirt roads. | Process in place if fault is identified at pre-start. | Informal training on tools, not recorded or documented. |
| Training not captured in Intuition | All torque tools were within calibration period, although would be at end of period (refer to report from SAMS). | | Trucks are prestarted every morning and every time the truck is started. Not documented. | No perceived time pressure. |
| Fitters given on job training but not documented. | Torque tools onsite include:<br>1. Norbar PT2000 Rad gun<br>2. Norbar Rad Gun<br>3. Norbar | | No formalised procedure in place to ensure nuts are re-torqued. | No service planner for the site. works with the site and uses Vision Link to determine when services are due. |
| Supervision considered adequate by investigation team. | Truck had performed empty and loaded training tasks | | Outer nuts visually inspected at pre-start however inner nuts can't be seen. | No Service Advisors in the field. There are 4 Foremen and 3 coordinators who are customer contacts for all customers, incl |
| Loose nuts found by fitter and tyre fitter (field service 4th year apprentice) | Truck was a Cat 785D rear dump truck. | | Customers/clients where we normally deliver trucks normally have their own retorquing procedures. | maintenance to conduct task conducted on hours for breakdown and PM maintenance |
| Trainee operators operating truck at training operation | Nuts and studs were compatible | | Pre-start process includes a requirement to check the integrity of wheel nuts. | assigned to site as |
| | Truck had been fully operational for 18 hours since delivery. | | No documented records of pre-starts. | centre open for 3 months. |

# Appendix C – ICAM Factors Analysis