Mines Inspectorate Report

Stephen Cave Fatality & Serious Injury to sch4p4(6) Personal information

Dawson Mine - 16 February 2015

File GCAN-9TT7GF

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Inspector of Mines

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Inspectors of Mines

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1. Jurisdiction & Scope

An investigation of serious accidents at mine sites is a function of the Mines Inspectors under Section 128 of *the Coal Mining Safety and Health Act 1999.*

Section 199 of the CMSHA 1999 provides that 'as soon as practicable after receiving a report of a serious accident causing death at a coal mine, an inspector must inspect the place of the accident, investigate the accident to determine its nature and cause, and report the findings of the investigation to the Chief Inspector'.

Appendix s.73 Irrelevant information

2. Glossary of Terms/Abbreviations

Abbreviations

CCTV	Closed Circuit Television
CMW	Coal Mine Worker
DNRM	Dept. Natural Resources & Mines
ISHR	Industry Safety & Health Representative
MMP	Modified Multi Piece
MRE	Mine Record Entry
MRT	Mine Rescue Team
NDT	Non Destructive Testing
Nm	Newton Metres
OEM	Original Equipment Manufacturer
PCC	Plain Clothes Constable
PSI	Pounds per square inch
QAS	Queensland Ambulance Service
QPS	Queensland Police Service
RBH	Royal Brisbane Hospital
SOP	Standard Operating Procedure
SSE	Site Senior Executive
SSHR	Site Safety & Health Representative
STI	Standard Task Instruction

3. List of persons named in report

Name	Occupation	Company/Organisation
Russell Albury	Acting Chief Inspector of Coal mines	DNRM
sch4p4(6) Personal information	Serviceman	Leighton Contractors / Dawson Mine
	Safety Manager	Anglo-American / Dawson Mine
	Maintenance Superintendent	Leighton Contractors / Dawson Mine
	Diesel Fitter	Frontline / Dawson Mine
Andrew Broadfoot	Authorised Officer	DNRM
Graham Callinan	Mines Inspector	DNRM
sch4p4(6) Personal information	Diesel Fitter	Leighton Contractors / Dawson Mine
	Project Manager	Leighton Contractors / Dawson Mine

Name	Occupation	Company/Organisation
sch4p4(6) Personal information	Diesel / Tyre Fitter	Leighton Contractors / Dawson Mine
	OCE	Leighton Contractors / Dawson Mine
	Technical Services Manager	Anglo-American / Dawson Mine
	Diesel / Tyre Fitter. 'C' Crew Leading Hand	Leighton Contractors / Dawson Mine
	'A' Crew Supervisor	Leighton Contractors / Dawson Mine
	Production Leading Hand	Anglo-American / Dawson Mine
	Diesel Fitter	Leighton Contractors / Dawson Mine
	Legal Representative	Anglo-American
	Queensland Manager	Rimex
	Plain Clothes Constable	QPS
	Apprentice Diesel Fitter	Leighton Contractors / Dawson Mine
Theo Kahl	Mines Inspector	DNRM
sch4p4(6) Personal information	MRT	Anglo-American / Dawson Mine
Anthony Logan	Mines Inspector	DNRM
sch4p4(6) Personal information	Acting Dragline Supervisor	Anglo-American / Dawson Mine
	Diesel Fitter	Frontline / Dawson Mine
	Serviceman	Leighton Contractors / Dawson Mine
	MRT	Workpac
	MRT	Anglo-American / Dawson Mine
Bruce McKinnon	Mines Inspector	DNRM
sch4p4(6) Personal information	N/A	sch4p4(6) Personal information
	MRT	Anglo-American / Dawson Mine
	MRT	Anglo-American / Dawson Mine
Mick McWilliam	Inspection Officer	DNRM
Mark Moffatt	Mines Inspector	DNRM
sch4p4(6) Personal information	MRT	Workpac
	SSE	Anglo-American / Dawson Mine
	Production Supervisor	Leighton Contractors / Dawson Mine
	Contract Holder	Anglo-American / Dawson Mine
Tilman Rasche	Senior Mines Inspector	DNRM
sch4p4(6) Personal information	Maintenance Manager	Anglo-American / Dawson Mine
	Contract Representative	Anglo-American / Dawson Mine
John Sleigh	Regional Manager – Safety & Health	DNRM
sch4p4(6) Personal information	Legal Representative	Anglo-American
John Smith	Senior Mines Inspector	DNRM
sch4p4(6) Personal information	MRT	Anglo-American / Dawson Mine
	Maintenance Supervisor	Leighton Contractors / Dawson Mine
Paul Sullivan	Mines Inspector	DNRM
sch4p4(6) Personal information	Maintenance Supervisor	Leighton Contractors / Dawson Mine
	Diesel Fitter	Leighton Contractors / Dawson Mine
	Diesel Fitter	Frontline / Dawson Mine

4. Executive Summary

At 4.40am, on Monday, 16 February 2015 sch4p4(6) Personal information Mr Stephen Cave, was killed, and another sch4p4(6) Personal information seriously injured, whilst in the process of fitting a Position 1 tyre onto CAT 777D Water Truck WT8006, at the Dawson South workshop.

The lock ring has come out of the lock ring groove of the rim on Position 1 wheel, and the tyre, tooling and components of the multi-piece assembly have ejected off the rim and struck both workers, fatally injuring Stephen Cave, and seriously injuring sch4p4(6) Personal infor

sch4p4(6) Personal information

Water Truck WT8006 had recently been transported to site from the Leighton Contractors yards in Nebo, and was in the process of being commissioned to work onsite at Dawson Mine. The commissioning involved a considerable amount of tyre handling to convert it from transport mode to operational mode. It also involved the replacement of the front two tyres.

There was no catastrophic failure of any of the rim components. For this incident to have occurred, the tyre must be pressurised, the lock ring not be seated correctly in the rim groove, and the components of the multi-piece rim assembly not binding as designed.

The investigation identified the following contributing factors:

- The lock ring installed onto Position 1 wheel was either not seated correctly in the groove of the rim, or had become partially dislodged before or during fitment of the wheel to the truck. This caused the lock ring to come out of the groove, which allowed the tyre and rim assembly components to be expelled off the rim when there was pressure in the tyre.
- There were insufficient competent personnel on the crew to undertake tyre handling tasks.
- The lock ring may not have been installed correctly due to the correct fitment process not being followed. The critical aspects of this fitment are the seating and concentric alignment of the lock ring into the rim groove.
- There is evidence (witness marks on the gutter section of the rim) that the lock ring had an excessive gap between the ends (38mm) when the lock ring was forced from the rim. The implication of this excessive gap is that the lock ring cannot have been seated correctly.
- Rim assembly components were from different manufacturing companies and this may allow a greater tolerance for the lock ring not being seated correctly.
- The bead seat band did not have a MMP (Surloc) ring welded to it. This important engineering control can contribute to preventing inflation when the lock ring is not correctly seated.
- The Dawson mine tyre management standard operating procedure was not complied with. The competencies and authorisations required by this standard to undertake tyre handling tasks were not followed.

- There were no developed safe work instructions or standard task instructions for the tyre handling tasks

- Supervision of the tyre management was less than adequate.

5. Details of Deceased / Injured Person/s

Name: Stephen sch4p4(Cave

sch4p4(6) Personal information

Name: sch4p4(6) Personal informat

sch4p4(6) Personal information

6. Details Location / Company Entity

Mine Name:	Dawson Mine
Mining Lease:	ML5656
Location:	Theodore – Baralaba Road, Moura, Queensland, 4718
Lease Holder:	Anglo Coal (Dawson) Pty Ltd
Mine Operator:	Anglo Coal (Dawson Management) Pty Ltd
Site Senior Executive:	sch4p4(6) Personal int
Company Name:	Anglo Coal (Dawson Management) Pty Ltd
Registered Address:	Level 11, 201 Charlotte Street, Brisbane, Queensland, 4001

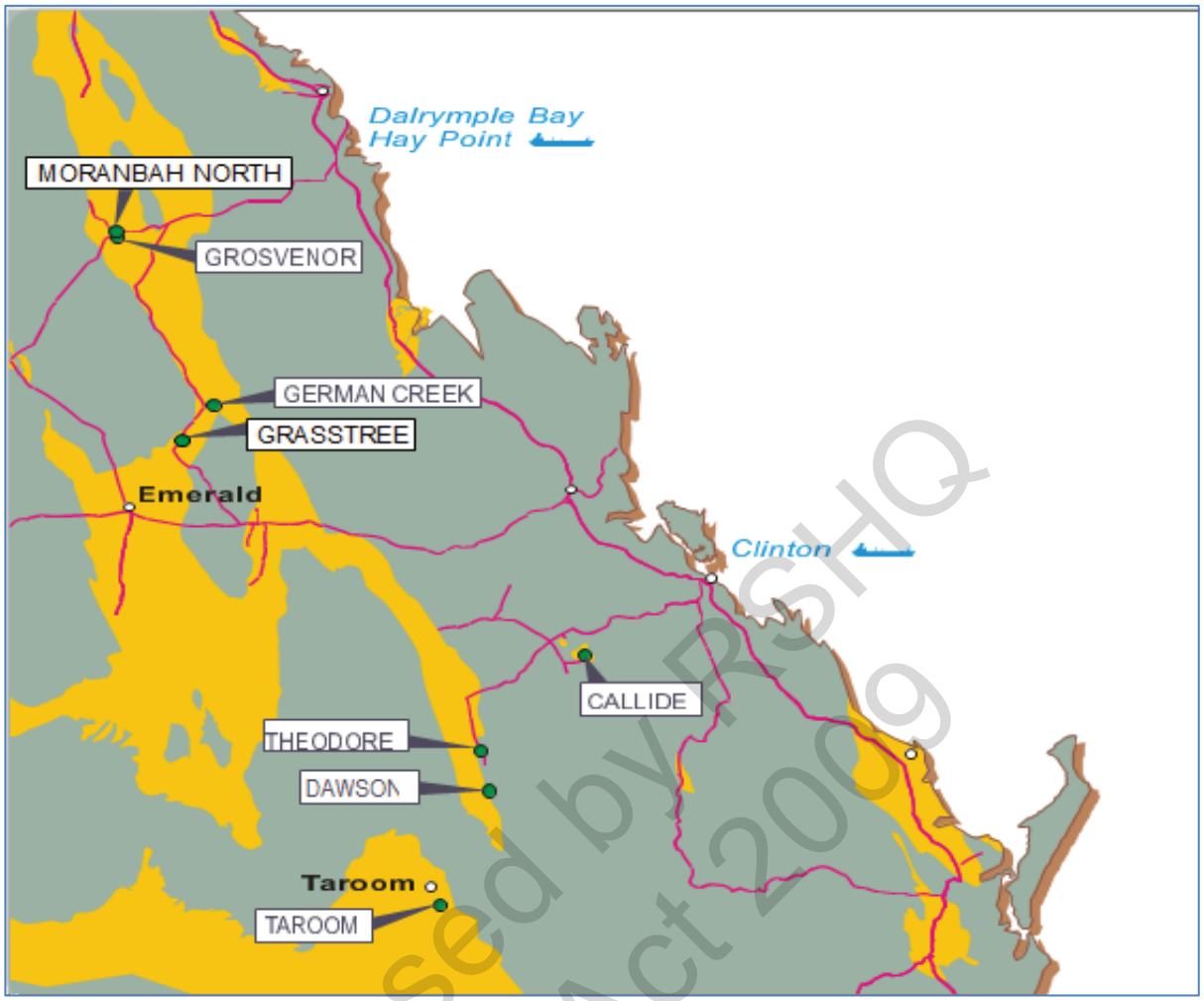

Figure 1: Map of Bowen Basin

The Dawson Mine is located at the southern end of the Bowen Basin, approximately two hours' drive from Rockhampton. It is a large open cut operation using Dragline and Truck & Shovel mining methods, and is capable of producing 9 million tonnes of thermal and metallurgical coal. The current workforce comprise of 750 permanent employees and 450 contractors. The mine is operated under one safety health management system (SHMS) across the two locations of Dawson South and Dawson Central. Figure 2 shows the Dawson South Workshop with the Leighton Contractors administration buildings in the background.

Figure 2: Dawson South Workshop with the Leighton Contractors administration buildings in the background (*taken by QPS prior to site release*).

7. Incident Details

7.1 Description of Incident

On the nightshift of Monday, 16 February 2015, sch4p4(6) Pe Mr Stephen Cave, and sch4p4(6) Pers sch4p4(6) Personal information were assigned the task of completing the tyre changing sequence on CAT 777D Water Truck WT8006.

At 0440 hours, Mr Stephen Cave was killed, and sch4p4(6) Personal info seriously injured, whilst in the process of fitting a Position 1 tyre onto the water truck. The lock ring of the multi-piece rim had come out of the lock ring retention groove, allowing the sudden pressure release of the tyre. This caused the tyre, parts of the multi-piece rim assembly and tooling, to be ejected off the rim base striking both workers, fatally injuring Stephen Cave, and seriously injuring sch4p4(6) Personal in

7.2 Events Leading Up to the Incident

The CAT 777D Water Truck WT8006 had been recently brought to site and was being commissioned to be put into service. The trucks plant number is WT8006 and the water tank attached has the plant number L06.

7.2.1 Water Truck WT8006

Figure 3: CAT 777D Water Truck WT8006 post incident (*taken by QPS prior to site release*).

Wednesday, 11 February – Water Truck WT8006 is bought from Nebo holding yard to Dawson South by NQ Heavy Haulage. (Unable to be unloaded Wednesday afternoon)

Thursday, 12 February – Water Truck WT8006 is unloaded in the morning outside the Dawson South Workshop. At 15:00hrs a work order is raised for a 250 hour service and commissioning for site use.

Friday, 13 February (Day & night shift) – Work is started on the 250 hour service and commissioning of the truck. Work commenced on the truck after the crew pre-start meeting.

Saturday, 14 February (Day shift only) – Further work is conducted on the 250 hour service and commissioning of the truck throughout the day.

Sunday, 15 February (Day and night shift) – Further mobilisation work conducted on the truck.

Note: The transportation of large trucks in transport mode normally requires that the wheels of the truck be orientated in the following manner:

The front wheels (Position 1 and Position 2) are removed and reversed, such that the longer offset of the rim base is external to the hub. This creates a wider wheel base and allows the wheels to hang over the sides of the transporter. The inner wheels of the rear duals (Position 5 & Position 4) are removed, and the outer wheels remounted, to allow these wheels to overhang the sides of the transporter.

Tyre position numbering below:

The water truck arrived at the mine in travel mode. As described above, this necessitated a number of wheel movements to put it into operational mode from transport mode. This process would involve the following sequence, or its equivalent:

1. remove Position 3
2. mount Position 4, drive a short distance and re-torque Position 4
3. mount Position 3, drive a short distance and re-torque Position 3
4. turn the truck around 180 degrees and repeat the sequence for Positions 5 and 6
5. remove Position 2, reverse and mount with large offset over the hub, drive a short distance and re-torque Position 2
6. turn the truck around 180 degrees and repeat the sequence for Position 1

The probable sequence of tasks to achieve these steps during Sunday dayshift, 15 February 2015, and the following shift, Monday nightshift, 16 February 2015, are shown to be similar to the above, but included replacing both existing front tyres with new ones, replacing a valve stem on Position 1, and re-seating a leaking tyre and rim assembly on Position 5.

7.2.2 Sunday Dayshift 15 February 2015 – the shift prior to the incident

The 'C' crew commenced work at 0600 hours and the usual pre-shift process was conducted. This included:

- The supervisor, sch4p4(6) Personal ir taking the crew through the handover report
- General hazard notifications
- Alcohol breath analysis
- Leighton Contractors Essential – there are twelve safety topics that Leighton Contractors focus on. A different one is a part of each shift's toolbox talk. It is not known which one was presented this shift (Appendix 2).
- Allocation of work.

Part of the allocation of work involved wheel re-positioning from transport mode to operational mode for Water Truck WT8006.

The crew members who were allocated to the above task were:

- sch4p4(6) Personal in – Maintenance Supervisor who stated that he also operated the Tyre Handler but has no tyre fitting competencies.
- sch4p4(6) Perso – Leading Hand and Tyre Fitter who also operated the Tyre Handler.
- sch4p4(6) Personal infc – Fitter (no tyre handling / fitting competencies)
- sch4p4(6) Personal infc Fitter (no tyre handling / fitting competencies)

The following is the sequence of events by the dayshift crew regarding working on Water Truck WT8006. This sequence was not started until later in the afternoon:

1. Water Truck WT8006 was parked on the workshop pad, facing south as per the General Arrangements drawing (Appendix 3). It was parked securely, chocked and the rear of the truck jacked up. The Position 3 tyre was deflated and the wheel then removed from the truck. This was to allow access to the hub of Position 4. Position 4 wheel was then fitted to the Position 4 hub and torqued. The tyre was then inflated, and once this had been done it was taken for a short drive before it was torqued again. Position 3 wheel was then mounted to the hub and was given its first torque sequence. It was torqued a second time after a short drive.

2. Water Truck WT8006 was then driven a short distance and rotated to face north. The truck was parked securely, chocked and the rear of the truck jacked up. Position 6 tyre was probably deflated to either 15psi, or 30 psi, and the wheel removed. The statements of sch4p4(6) Personal i sch4p4(6) Perso nd sch4p4(6) Personal infc are not clear on this (Appendix 4). This was to allow Position 5 wheel and tyre assembly to be fitted to the truck. When Position 5 wheel was picked up by the Tyre Handler, it was observed that the tyre was deflated. When attempts were made to inflate the tyre it would not hold pressure. The tyre was then pressed down by the Tyre Handler, and it was discovered that the 'O' ring had been damaged. The 'O' ring was then replaced, however, the tyre would still not hold air pressure, so it was decided that it need to be completely 'broken down' or disassembled. This was then undertaken and the stripped down wheel was left for the next crew (night shift). There was no further work recorded as being done on the wheels of this truck for this shift.

   sch4p4(6) Personal inf stated in his interview that he cannot recall sch4p4(6) Personal i operating the Tyre Handler. sch4p4(6) Pers in his statement said he would get in and out of the Tyre handler approximately nine times to check on the work being done.

3. In the shift handover signed by sch4p4(6) Personal inf and sch4p4(6) Personal info regarding Water Truck WT8006, the night shift crew were required to:

- Complete cleaning of the rim assembly and re-assemble Position 5 wheel
- Fit and torque, and after taking the truck for a short run, re-torque Position 3 and 5 wheels
- Fit Position 6 wheel, torque wheel nuts, take the truck for a short run and then re-torque
- There is a statement in the handover sheet that indicates that sch4p4(6) Personal inf and sch4p4(6) Personal in were 'not sure what else needs to be done' (Appendix 5).

4. The handover to nightshift is normally done with the crews talking directly to each other; however, both sch4p4(6) Personal information were not at this handover meeting. The handover was done between sch4p4(6) Personal ir the 'C' crew leading hand sch4p4(6) Pers and the nightshift 'A' crew leading hand sch4p4(6) Personal and 'A' Crew Maintenance Superviso sch4p4(6) Personal information states that the handover was to complete wheels Position 5 and Position 6, and also to fit new tyres to Position 1 and Position 2 wheels. Position 1 and Position 2 wheels were not in the written handover.

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7.2.3 The Night Shift Commencing 1800 hours on 15 February 2015

On Sunday, 15 February 2015, 'A' crew commenced their second last nightshift of a seven day roster. The crew comprised of the following personnel:

- sch4p4(6) Personal Maintenance Supervisor
- Leading hand
- sch4p4(6) Personal – Diesel Fitter
- sch4p4(6) Personal in Serviceman
- Diesel Fitter
- Diesel Fitter (Frontline)
- sch4p4(6) Personal inform Diesel Fitter (Frontline)
- sch4p4(6) Personal inf- Diesel Fitter (Frontline)
- Serviceman
- sch4p4(6) Personal info Apprentice Diesel Fitter

The crew was made up of Leighton Contractors employees, with the exception of three labour hire CMWs who were employed by the labour hire company Frontline, and contracted directly to Leighton Contractors.

At 1745 Hours sch4p4(6) Persona and sch4p4(6) Persona undertook a handover with the dayshift 'C' crew supervisor sch4p4(6) Personal i and the 'C' crew leading hand sch4p4(6) Perso This handover provides the following crew with information of ongoing work to be carried out as well as any issues they may encounter.

sch4p4(6) Personal information

sch4p4(6) Person The crew's shift commences at 1800 hours, and it involves a shift prestart meeting with the crew and their supervisor, and the leading hand. The meeting comprised of:

- An alcohol breath test for all the crew
- Review of a safety board, and changed conditions or hazards
- Job handovers from the previous shift and allocation of work
- A Leighton Contractors Essential safety talk. It is unsure what the topic on this shift was.

The following was the allocation of work for this shift:

- sch4p4(6) Personal ir and sch4p4(6) Personal undertake repairs to TC8171 dozer in workshop
- sch4p4(6) Personal infor and sch4p4(6) Personal i sent from the workshop for field work
- sch4p4(6) Personal was in a service truck
- sch4p4(6) Personal was in a service truck and general assistant in the workshop
- sch4p4(6) Personal ompleting paperwork in the office
- sch4p4(6) Personal information were to complete fitment of tyres / wheels to Position 5, Position 6, Position 3, and new tyre fitment and rotation of Position 2 and Position 1 wheels. The written handover from the previous crew does not indicate the work to be done for Position 1 and Position 2 wheels (Appendix 6).

At approximately 1830 hours, sch4p4(6) Personal approached sch4p4(6) Person and stated that he did not have the paperwork indicating the torqueing status of the inflated wheel Position 3. A phone conversation with the day shift tyre fitter sch4p4(6) Perso was conducted to clarify what work was still to be completed on Water Truck WT8006 during the night shift, and this was communicated to sch4p4(6) Personal i

sch4p4(6) Personal information *The more precise times are taken from CCTV footage*:

After the pre-shift meeting and while waiting fo sch4p4(6) Personal ir o get additional information from the previous crew, sch4p4(6) Personal commenced preparing for the shift by getting the necessary tools, sockets, jacks, stands, compounds and 'O' rings ready, and he also set out the airlines (Appendix 7) sch4p4(6) Personal information commenced work on the truck between 1900 hours and 1930 hours. sch4p4(6) Personal information completed a Step Back Take 5, which is an individual workers task and environment assessment of hazards and controls (Appendix 8). It should be noted that there was no evidence found that the Step Back Take 5's had been completed by sch4p4(6) Personal information for this shift. Note: The example in Appendix 8 is from sch4p4(6) Personal i he previous shift.

They placed their danger tags and locks onto the isolation point of the truck, and commenced their tasks. By 2330 hours sch4p4(6) Personal information had completed the following:

1. Re-assembled Position 5 rim and tyre (re previous shift), and mounted the wheel onto the truck. This was then torqued and completed.
2. Torqued Position 3 – the wheel only needed the torque sequence completed.
3. Mounted Position 6 wheel onto the truck and completed the torque sequence.
4. Had first crib which lasted from 2208 hours to 2241 hours.

The above work was undertaken by both sch4p4(6) Personal information There was no supervision of the work undertaken on Position 3, 5 or 6 wheels, and no other assistance was obtained by them. The lighting tower that was providing the area illumination failed in service at 1912 hours, just into the start of the shift, and could not be re-started. Therefore the only illumination for undertaking tyre handling tasks was personal cap lamps, and the Tyre Handler lights.

sch4p4(6) Personal information

interview transcript:

sch4p4(6) Persona had been assisting sch4p4(6) Personal information with repairs to TC8171 dozer in the workshop. These repairs required sch4p4(6) Personal to undertake cleaning parts removed from the Dozer, and wire wheel buffing of these parts. This involved sch4p4 using the cleaning bay nearby to where sch4p4(6) Personal information were working on the water truck, as well as borrowing some of their cleaning tools, such as the buffing wheel (Appendix 9). During this cleaning, he had some general interaction with them throughout the shift. On completion of his assistance on the repairs of the dozer, sch4p4(6) Personal went over to the water truck and applied his danger tag and lock to the truck's isolation point. He then went to assist sch4p4(6) Personal information with the replacement of Position 2 tyre and installation of the wheel on the water truck.

On his arrival, the tyre and rim assembly for Position 2 was on the ground with the existing tyre already removed from the rim. The new tyre was on the rim with the bead seat band being installed. The Tyre Handler being operated by sch4p4(6) Personal in was used to compress the tyre and rim assembly so that they could install the 'O' ring and the lock ring.

Once the lock ring had been installed, the Tyre Handler was parked up and a process of inflating the tyre was commenced. The large bore inflator was connected onto the valve stem, and sch4p4(6) Personal controlled the pressure into the tyre by operating a cock positioned on the hose approximately 3 to 4 metres from the valve connection point.

A 'large shot of air' was applied to the tyre to seat it up against the lock ring, with sch4p4(6) P sch4p4(6 located in the centre of the rim. When the tyre and lock ring were seated – initially indicated by a popping noise sch4p4(6) Personal went through a process of tapping the lock ring with a hammer to further confirm that the lock ring was positioned correctly sch4p4(6) Personal in had an issue with the tyre air pressure gauge and sourced a replacement gauge. The inflation process was regularly stopped, with checks made on the lock ring by lightly tapping with a hammer to ensure the lock ring was properly seated.

Once the tyre was inflated to approximately 30psi the valve was screwed back into the stem, and the large bore inflator removed from the wheel sch4p4(6) Persona then removed himself from the rim assembly, away from the tyre.

sch4p4(6) Personal in who had remained in the Tyre Handler during the above process, used the arms of the Tyre Handler to squeeze the tyre to ensure that there were no concerns with the re-assembly of the rim components. He then used the Tyre Handler to pick up the wheel to mount it onto the Position 2 hub. Both sch4p4(6) Personal on one side of the wheel, and sch4p4(sch4p4(6) Per on the other side, provided instructions to sch4p4(6) Personal assisting him to align the wheel onto the Position 2 wheel studs on the hub.

When the wheel was in place on the studs, and sch4p4(6) Personal confirmed that the Tyre Handler would remain stationary holding the wheel, sch4p4(6) Personal and sch4p4(6) Persona went under the arms of the Tyre Handler and approached the wheel. They put 'a couple of nuts' onto the studs and used a pneumatic tensioning device (rattle gun) to secure the wheel to the hub, then moved away from the Tyre Handler. This allowed sch4p4(6) Personal i to remove the Tyre Handler from the wheel and reverse it back out of the way. sch4p4(6) Personal and sch4p4(6) P sch4p4(6 put the remaining nuts onto the studs and tightened them with the rattle gun. When this was completed, the inflation process of taking the tyre pressure from 30psi to the operating pressure of 110psi was commenced. The large bore inflator was connected onto the valve stem by sch4p4(6) Personal information controlled the pressure into the tyre by operating a cock positioned on the hose approximately 3 to 4 metres from the valve connection point. sch4p4(6) Personal was confirming the readings on the pressure gauge. Tyre

inflation ceased at the operating pressure of 110psi. The valve was screwed back into the valve stem, and the large bore inflator was removed from the wheel.

A pneumatic tensioning tool (Norbar) was then checked by sch4p4(6) Persona at a designated test bench nearby, to confirm that the Norbar would tension the wheel nuts to the required torque setting sch4p4(6) Personal then used the Norbar to do the first torque tension on all the wheel nuts. Once this was completed, sch4p4(6) Personal came out of the Tyre Handler, and assisted by sch4p4(6) Personal noted down the rim component identification details which are stamped into the components. It was decided to remove the danger tags and locks from the isolation point of the water truck, and for it to be driven out of the area and turned around, and brought back into the area to allow access to work on Position 1 wheel.

sch4p4(6) Persona then drove the water truck out to reposition it back on the pad while sch4p4(6) Pe sch4p4(6 directed him. Once the water truck was parked into its new position, all three went to have their second crib at 0204 hours.

Appendix s.73 Irrelevant information

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sch4p4(6) Personal information *The more precise times are taken from CCTV footage*:

After returning from their crib break at 0251 hours to the water truck, sch4p4(6) Personal informat sch4p4(6) Personal i commenced to undertake the task of removing Position 1 wheel from the hub, breaking down the rim assembly, replacing the tyre, and re-assembling the rim and new tyre. They were then to put the wheel back onto the Position 1 hub and tension / torque the wheel nuts.

The first task is isolation of the truck but it does not appear that sch4p4(6) Personal information sch4p4(6) isolated the truck correctly, as neither of their danger tags or personnel locks were locked onto the isolation point. Figure 4 shows both sch4p4(6) Personal information danger tags and personal locks not applied to the isolation point of the truck.

Figure 4 sch4p4(6) Personal information danger tags and personal locks not applied to the isolation point of the truck (*DNRM photo taken at the incident scene*).

sch4p4(6) Personal i and sch4p4(6) Persona worked together to jack the truck up and place it onto the jacking stands, so that the wheel was about 15cm off the ground ready to be removed. sch4p4(6) Personal in hen requested sch4p4(6) Personal to reduce the tyre pressure to 30psi. sch4p4(6) sch4p4(6 emoved all but four of the wheel nuts from the studs and placed them in a nearby bucket. sch4p4(6) Personal i was now in the Tyre Handler and when there were only four nuts holding the wheel in place, he positioned the Tyre Handler so that its hydraulic arms could grab the tyre / wheel and hold it firmly to allow safe removal of the remaining wheel nuts. sch4p4(6) Personal then went in under the Tyre Handler arms and gained access to the wheel. He removed the remaining four nuts and got back out of the way of the Tyre Handler. Once he was known to be clear of the wheel and Tyre Handler sch4p4(6) Personal in eversed the Tyre Handler about 6 meters from the truck carrying the Position 1 wheel.

The hydraulic arms of the Tyre Handler were operated to lower the wheel so that it was placed horizontally on the ground with the valve stem and lock ring facing up. sch4p4(6) Personal inf then requested sch4p4(6) Personal to let the remaining air out of the tyre, fully deflating it. The large bore inflator was connected onto the valve stem by sch4p4(6) Personal and the valve withdrawn into it. It took 'a couple of minutes' to completely deflate the tyre. A pressure gauge was used to confirm full deflation.

As part of the investigation a video of the replacement of a tyre was conducted by Dawson Mine. From this re-enactment it took just under 3 minutes to completely deflate a tyre from 110 psi to O psi (Appendix 10).

sch4p4(6) Personal then notified sch4p4(6) Personal i hat the tyre was deflated. sch4p4(6) Personal ir manoeuvred the Tyre Handler so as to position both of its arms over the tyre close to the rim, and then operated the hydraulics of the Tyre Handler to push the arms downwards on the tyre compressing it. This process breaks the connection that has been formed between the tyre and the rim components 'breaking the bead'.

sch4p4(6) Personal information

sch4p4(6) Personal informati *Figure 5 shows the bead seat breaker on the orange step (foreground)*

Figure 5: Bead Seat Breaker on the Orange Step (*DNRM photos taken at the incident scene*).

Once it was observed that the tyre bead had been pushed away from the bead seat band, sch4p4(6) Personal held the Tyre Handler arms in this position, keeping downward pressure on the tyre.

With the tyre pushed down sch4p4(6) Persona then used a tyre lever to partially lift the lock ring out of the rim groove, and then used a second tyre lever to fully dislodge the lock ring from the rim groove by running it around the circumference of the rim. After removal of the lock ring from the rim, the 'O' ring was pulled out of its groove and discarded.

With the rim components disassembled, sch4p4(6) Persona then stood back and watched sch4p4(6) Personal use the Tyre Handler to pick up the tyre, and remove it from the area to the tyre storage area located approximately 150 metres away. It was at this area that sch4p4(6) sch4p4(picked up the new replacement tyre and carried it back to the water truck.

While sch4p4(6) Personal and the Tyre Handler were away sch4p4(6) Personal commenced cleaning the rim, the grooves of the rim and the lock ring. While the Tyre Handler was absent the only illumination for sch4p4(6) Personal to undertake this task was his cap lamp and low level general area lighting. sch4p4(6) Persona took his hard hat, with the cap lamp attached, off his head and attempted to position the hard hat so that the cap lamp illumination would shine on the components he was cleaning. He put on the Perspex face shield required to be worn when using the wire wheel attachment on the grinder. He believes he cleaned the components for 10 to 15 minutes until the Tyre Handler returned with the new tyre. When sch4p4(6) Personal i returned with the new tyre he got out of the Tyre Handler and inspected the rim assembly components cleaned by sch4p4(6) Personal

sch4p4(6) Personal then applied the tyre lubrication colloquially called 'fat', to the inside edges of the new tyre. This lubrication assists in assembling the tyre and the multi-piece rim. Whilst applying the lubrication compound, sch4p4(6) Personal was in the Tyre Handler and the new tyre was held in the arms of the Tyre Handler in a vertical position. The rim assembly components were on the ground nearby.

sch4p4(6) Personal information

VERSION 1

sch4p4(6) Personal information

While sch4p4(6) Personal was lubricating the tyre, sch4p4(6) Persona came over to him and enquired how the job was progressing. sch4p4(6) Persona then asked why the valve stem had not been replaced with a new one. sch4p4(6) Personal told sch4p4(6) Persona that he had not been informed that it was a requirement to do so. sch4p4(6) Persona stated that all valve stems should be replaced every time a tyre is changed. sch4p4(6) Persona and sch4p4(6) Personal then went into the tyre fitter's container where they located a new valve stem. They returned to the water truck and sch4p4(6) Persona replaced the valve stem himself. He then left the work area sch4p4(6) Personal inform then returned to the task of lubricating the tyre.

Once this task was completed sch4p4(6) Persona informed sch4p4(6) Personal and the tyre was then rotated horizontally and positioned so that it could be slid down over the rim on the ground.

sch4p4(6) Personal i then used the Tyre Handler to collect the flange, bead seat band, and lock ring. These were the original components that were removed from the wheel. Once the flange and bead seat band had been lowered onto the rim, sch4p4(6) Personal used the arms of the Tyre Handler to push down and compress the tyre to allow the lock ring to be installed into the rim groove.

sch4p4(6) Personal inserted the lock ring into this groove by levering it in with a tyre lever. He then used a hammer to lightly tap the circumference of the lock ring to check that it was clamped into the rim groove. A replacement 'O' ring that sch4p4(6) Personal had lubricated was then placed into the 'O' ring groove on the rim.

sch4p4(6) Personal then informed sch4p4(6) Persona that the lock ring was in position, and sch4p4(6) Pe sch4p4(6) lifted the arms of the Tyre Handler off the tyre which allowed it to reshape itself against the rim components. sch4p4(6) Personal was then directed to connect the large bore inflator to the valve stem, and to inflate the tyre to 30psi for the purpose of seating the tyre onto the bead.

Once this had been done, sch4p4(6) Personal emoved the large bore inflator from the valve stem. sch4p4(6) Personal operated the Tyre Handler so that the wheel was picked up by the arms of the Tyre Handler, lifted off the ground, and rotated to a vertical position.

VERSION 2:

sch4p4(6) Personal information *This is his account of the valve replacement sequence of events. The more precise times are taken from CCTV footage:*

At 4:10:15 hours sch4p4(6) Persona walked through the workshop to inspect the progress of the tyre handling tasks that sch4p4(6) Personal and sch4p4(6) Personal were undertaking. When he arrived the tyre and rim components had been assembled and the wheel was being held in the vertical position by the Tyre Handler, with the bottom of the tyre touching the ground. sch4p4(6) P sch4p4(6) as about to clean the back of the nave plate of the wheel. This part of the plate is a mounting face that contacts against the hub. sch4p4(6) Personal had the grinding wheel ready to clean the mounting faces (Appendices 11 and 12).

sch4p4(6) Persona observed that the valve stem 'was facing up and going the wrong way', which

is indicative that the wheel may have been an inside real wheel (Position 4 or Position 5) at some point in its history. The stem was 'about a foot long' and had a 90 degree fitting which was connected to the rim. sch4p4(6) Persona told sch4p4(6) Personal who was still in the Tyre Handler, that he was going to change out the valve stem. The stem he was going to replace it with was about six inches long, 'which we run on the front'. sch4p4(6) Persona then accompanied sch4p4(6) Persona to the tyre fitter's container approximately 15 metres away, and sourced a replacement stem that was six inches long. sch4p4(6) Personal remained in the Tyre Handler. They returned to the wheel after 'a couple of minutes', and sch4p4(6) Persona replaced the valve stem while being observed by sch4p4(6) Personal i This took two minutes.

The valve stem replacement that was connected to the large bore inflator at the time of the incident was not as described by sch4p4(6) Persona *It was well over a foot long and matched the description of the one he was going to remove (see Figures 25 and 26).* sch4p4(6) Personal *tated in a response to whether the valve stem pictured in Figure 26 was the one he installed into the wheel, that 'I cannot be sure that the valve extension stem is the same one fitted by* sch4p4 *To the best of my recollection, the extension stem was approximately 6 inches in length, but that extension appears longer'. If* sch4p4(6) *account of the replacement is correct then the valve stem may have been replaced again after he left (Appendix 13).*

sch4p4(6) Personal did not need to deflate the tyre to replace the valve stem as the tyre was not pressurised. sch4p4(6) Persona stated that the valve core - *which he has referred to as a spud in part of his transcript* – was not in the original valve stem, and so there was not the ability for the tyre to hold pressure. Once sch4p4(6) Persona had completed the valve stem replacement, he went back to his office walking through the workshop at 4:22:29 hours, and did not return to the work area until the incident had occurred.

sch4p4(6) Personal information *The more precise times are taken from CCTV footage:*

Once the tyre was in the vertical position, sch4p4(6) Personal hen guided the Tyre Handler towards the hub so that the wheel studs aligned with the nave plate holes. When the wheel was located on the studs sch4p4(6) Personal in ndicated that the Tyre Handler was parked and would not move. sch4p4(6) Persona ducked back under the arms of the Tyre Handler and used the pneumatic rattle gun to secure four wheel nuts, which is sufficient to hold the wheel onto the hub. This allowed the Tyre Handler to release its grip on the tyre and reverse back away from it.

Once the Tyre Handler was clear of the area by a few metres sch4p4(6) Personal proceeded to put the remaining 20 nuts onto the studs (hand-tight). The pneumatic rattle gun was then used to tighten all the nuts. This was not done to any particular sequence; however, it was done in a methodical manner working alternately on opposite nuts.

sch4p4(6) Personal i was now out of the Tyre Handler and was setting up the Norbar in preparation for the initial torque tightening of the wheel nuts to a specified tension. This involves adjusting the settings on the Norbar so that the workshop air supply provides the correct torque from the tool. This is done at a designated workshop bench.

Once sch4p4(6) Personal had installed all the wheel nuts with the rattle gun, he then used a soft metal hammer to again lightly tap the lock ring around its circumference to confirm that it was seated correctly.

sch4p4(6) Personal then removed the rattle gun, associated airline, and the bucket used to temporarily store the wheel nuts, away from the area. sch4p4(6) Personal then connected the airline to further inflate the tyre sch4p4(6) Personal then commenced setting up the Norbar to torque the wheel nuts while the tyre was being inflated sch4p4(6) Personal and sch4p4(6) Personal info

were not in front of the tyre while this inflation was occurring. It cannot be confirmed what sch4p4(6) Persona then did, however, when sch4p4(6) Personal returned to the Position 1 wheel after cleaning the area, he saw sch4p4(6) Personal was standing in front of the wheel and was using the Norbar to torque the wheel nuts. The large bore inflator was connected to the spud. sch4p4(6) Personal believed the air supply to the large bore inflator was turned off. sch4p4(6) Personal was approaching sch4p4(6) Personal to assist him with torqueing the wheel nuts. When he was about 5 metres from sch4p4(6) Personal at an angle of approximately 45 degrees, the lock ring came out from the lock ring rim groove and the sudden release of pneumatic pressure caused the tyre, bead seat band, outer flange, 'O' ring, large bore inflator, air hoses, and the lock ring to be propelled off the rim. Some of these parts struck and killed sch4p4(6) Personal i It is unclear which of the parts struck and seriously injured sch4p4(6) Personal except that due to the position of where the tyre was found it is not believed that it was the tyre.

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7.3 Notification of Incident

0610 hours – Monday, 16 February 2015, Regional Manager – Safety & Health Central Region, John Sleigh, was informed by Deputy Chief Inspector of Mines, Russell Albury, that the ABC News was reporting a fatality from a tyre 'explosion' near Moura.

0642 hours – Senior Mechanical Inspector, John Smith, based in Brisbane, was contacted by John Sleigh and requested to arrange to travel to the mine to take part in an investigation of the incident. Senior Inspector of Mines, Tilman Rasche, based in Brisbane, was also instructed to attend the mine.

0700 hours – The Dawson Mine Safety, Health and Environment Manager, sch4p4(6) Persona sch4p4(6) Pe notified Inspector of Mines, Graham Callinan, that two CMWs employed by the contracting company Leighton Contractors, had suffered significant injuries as a result of a tyre fitting incident to a CAT 777D Water Truck WT8006.

This resulted in John Sleigh contacting Mines Inspector, Paul Sullivan, and Authorised Officer, Andrew Broadfoot, at 0704 hours, both based in Rockhampton. He confirmed that a fatality and a serious injury had occurred and requested that they attend the mine and commence the initial stages of the investigation.

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7.4 Emergency Response

The catastrophic failure of the Position 1 wheel occurred at 0438 hours on Monday, 16 February. A loud 'explosion' was heard at this time by Crew Supervisor, sch4p4(6) Persona who was in the supervisor's workshop office approximately 40 metres away at the other end of the workshop. The 'explosion' was also heard in the Leighton Contractors administration office by Acting Dragline Supervisor, sch4p4(6) Person approximately 120 metres from the truck, as well as by some Leighton Contractors employees in the adjacent muster area (Appendix 16).

sch4p4(6) Persona responded immediately and went to where Water Truck WT8006 was being worked on by sch4p4(6) Personal and sch4p4(6) Personal He identified sch4p4(6) Persona as lying on his

side, close to the Position 1 hub. sch4p4(6) Personal information sch4p4(6) Personal information He could not readily determine where sch4p4(6) Personal was, however, he noted the Position 1 tyre was on the ground and between the arms of the Tyre Handler. The tyre at the front of the Tyre Handler was five meters away from the Position 1 hub and in a line perpendicular to the truck.

Figure 6: Photo of the Position 1 tyre placed back where it was found at the time of the incident. It had to be moved initially to retrieve the deceased (*taken by QPS prior to site release*).

He then looked over the Tyre Handler's arm and saw sch4p4(6) Personal i who was the between the tyre and the arms of the Tyre Handler. sch4p4(6) Personal information sch4p4(6) Personal information

sch4p4(6) Persona climbed up into the Tyre Handler and used the two way radio to report the emergency. His radio call indicated that 'there may be a fatality'. From a recording of the radio calls, the emergency call was carried out in a competent manner.

He then turned off the engine of the Tyre Handler and climbed back down out of the Tyre Handler cabin, and ran back to his office to grab a hand held two-way radio. He observed that the black air hose that supplied the pneumatic tools was blowing air, and the end was near Position 2 wheel.

OCE, sch4p4(6) Personal ir sch4p4(6) Persona Production Supervisor, sch4p4(6) Per and Production Leading hand, sch4p4(6) Person arrived at the scene of the incident within a few minutes of the emergency call sch4p4(6) Persona had already contacted Mines Rescue Team member (MRT) sch4p4(6) Personal inf to come to the workshop (Appendix 17).

sch4p4(6) Personal information

Together sch4p4(6) Person sch4p4(6) Per and sch4p4(6) Person ascertained that sch4p4(6) Persona had significant injuries sch4p4(6) Personal and that Stephen Cave was deceased. sch4p4(6) Person left the scene to act as the ambulance escort, and sch4p4(6) Personal information sch4p4(6 Once sch4p4(6) Personal in had established that sch4p4(6) Persona was coordinating the emergency response, he asked sch4p4(6) Pe to go back into the workshop and ensure that no-one else could enter into the area until it could be secured. sch4p4(6) Personal information sch4p4(6) Personal until MRT member sch4p4(6) Personal info arrived on the scene and commenced

first aid to sch4p4(6) Personal While sch4p4(6) Personal int was assisting sch4p4(6) Personal i sch4p4(6) Personal was relaying sch4p4(6) Personal ondition to the dispatcher.

sch4p4(6) Personal information

sch4p4(6) Personal information sch4p4(6) Personal assisted with locating equipment such as tarps, rags and the co-ordinates for the rescue helicopter; however, he did not go near the incident scene.

Other emergency response members sch4p4(6) Personal information sch4p4(6) Personal information and sch4p4(6) Personal in had now arrived and were assisting with securing the area, providing first aid to sch4p4(6) Persona and assisting the Queensland Ambulance Service (QAS) when they arrived s.73 Irrelevant informa sch4p4(6) Personal information sch4p4(6) Personal information

sch4p4(6) Personal information

Timeline of Emergency Response

Time	Event
0438 hours	Loud explosion heard by in the supervisor's office by Supervisor, sch4p4(6) Perso
	Supervisor sch4p4(6) Person leaves the supervisor's office to investigate
0440 hours	Emergency declared over 2 way radio to dispatch by sch4p4(6) Person
	Supervisor sch4p4(6) Person runs towards Administration building to get help
0441 hours	OCE sch4p4(6) Personal and Dragline Step up Supervisor sch4p4(6) Pers arrive on the scene to provide assistance
	Dragline Step up Supervisor, sch4p4(6) Pers requests mines rescue team support from dispatch
0447 hours	Dispatch calls Queensland Ambulance Service (QAS) on 000
0448 hours	Initial call received by s.73 Irrelevant information
0451 hours	First MRT member arrives sch4p4(6) Personal infor
0454 hours	Theodore QAS on way to meet mines rescue
0455 hours	Dragline Step up Supervisor, sch4p4(6) Pers radios dispatch to request air ambulance
0459 hours	Dragline Step up Superviso sch4p4(6) Per radios dispatch to request Helicopter to Dawson South
0503 hours	Mines Rescue truck arrives on scene
0510 hours	Moura Police notified of incident by Dawson Mine
0512 hours	QAS Ambulance from Theodore arrives on the scene
0520 hours	s.73 Irrelevant information
0550 hours	QAS Ambulance from Moura arrives on the scene
0557 hours	QAS Ambulance leaves site with sch4p4(6) Personal information

0620 hours	s.73 Irrelevant information
0700 hours	sch4p4(6) Personal information
0945 hours	
1400 hours	
1515 hours	Police hand over the scene to the DNRM Inspectors

Table 1: Timeline of Emergency Response

sch4p4(6) Personal information

The information for the timeline below is from the rescue services:

QAS	s.73 Irrelevant information	Air Ambulance & Brisbane QAS
0447 hours – contacted by the mine		
	0448 hours – contacted by the mine	
0455 hours – on route from Theodore to the mine		
	0505 hours – confirmed requested to go to site by the mine	
0512 hours – arrived on site		
0515 – QAS with sch4p4(6) Personal	0520 hours – s.73 Irrelevant information s.73 Irrelevant information	
0550 hours – QAS Moura arrived on site		
0557 hours – commenced transport to sch4p4(6) Personal infor		
0606 hours – QAS at sch4p4(6) Pe sch4p4(6) P	0605 hours s.73 Irrelevant information	

sch4p4(6) Personal information

		sch4p4(6) Personal information

Table 2: Timeline from Rescue Services

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7.5 Chronology of Events

Position 1 Tyre Handling Sequence from CCTV footage

There are more time events in the appendix than are listed in the table below (Appendix 20). Not all time events that are listed are included because there are assumptions and observations made that cannot be substantiated but are indicative of what may have been expected practice. There a two possible scenarios against time observations in the appendix. The statements made in interviews, CCTV footage and expected tyre handling practices form the basis of the scenarios.

Time Hr/Min/Sec	CCTV	Event	Comment
01:26:04	Cam 1	Tyre Handler drives off to collect new tyre for Position 1	This does not support sch4p4(6) Personal recollection of events
01:30:36	Cam 1	Tyre Handler returns with new tyre for Position 1	This does not support sch4p4(6) Personal i recollection of events
01:31:04	Cam 1	Tyre Handler drives off leaving tyre close to Water Truck	
01:54:25	Cam 1	Water Truck drives off to turn around	Turning the truck around allows Position 1 wheel to be accessed. It had previously been positioned for access to Position 2 wheel.
01:55:42	Cam 1	Water Truck is parked for Position 1 wheel removal	
01:56:18	Cam 1	Driver sch4p4(6) Personalights from Water Truck	
02:04:00	Cam 1	A number of CMWs go for crib	sch4p4(6) Personal information
02:51:16	Cam 1	4 leave crib room and head towards workshop	
03:00:28	Cam 1	CMW walks to the air reticulation supply point for the Water Truck	
03:00:59	Cam 1	CMW returns from air reticulation supply point and goes around the rear of the Water Truck	

Time Hr/Min/Sec	CCTV	Event	Comment
03:02:20	Cam 1	Front of the Water Truck elevates. This takes 20 seconds.	The Water Truck is being placed on stands to allow the Position 1 Wheel to be removed. Tyre deflation is not started until this is completed.
03:04:33	Cam 1	CMW at rear of Water Truck walks to the air reticulation supply point. Then walks back around the rear of the Water Truck. This takes 13 seconds.	With the Water Truck on stands, the next step in the wheel removal would involve deflating the tyre to a handling pressure.
03:05:46	Cam 1	CMW is looking at the new tyre near the Water Truck. This takes 19 seconds.	
03:09:43	Cam 1	CMW walks to the air reticulation supply point for the Water Truck. Then walks back around the rear of the Water Truck. This takes 38 seconds.	There is sufficient time for the tyre to be deflated to a handling pressure. The next step in the wheel removal would involve removing the wheel nuts and taking the wheel off the hub.
03:14:55	Cam 1	Tyre Handler picks up the new tyre at the back of the Water Truck.	The new tyre is being moved about including rotating the tyre.
03:19:42	Cam 1	The Tyre Handler places the new tyre back down and then returns to near the Position 1 area of the Water Truck.	
03:21:35	Cam 1	Bursts of exhaust are seen from the Tyre Handler on six occasions over the next ten minutes till 03:31:04.	The bursts of exhaust are indicative that the Tyre Handler is revving or under load.
03:40:32	Cam 1	CMW is observed around new tyre for the next 30 seconds.	
03:43:18	Cam 1	For the next six minutes there is activity involving the Tyre Handler and a CMW with the new tyre.	This may be the tyre being prepared for assembly onto the rim components.
03:49:53	Cam 2	CMW observed walking in workshop - a vehicle believed to be a service truck starts up and drives off very soon after.	This person was identified as being the Leading Hand, sch4p4(6) Perso This identification was done by the Supervisor, sch4p4(6) Persona during his second interview.
03:53:01	Cam 1	The Tyre Handler, having just picked up the new tyre, takes it to the Position 1 work area.	This may be the tyre being assembled onto the rim components.
04:08:38	Cam 1	CMW observed at rear of Water Truck.	
04:10:47	Cam 2	CMW seen walking across workshop in the direction of the Water Truck.	Supervisor sch4p4(6) Persona identified that this was himself during his second interview.
04:11:04	Cam 1	CMW at rear of Water Truck walks to the air reticulation supply point	This would be just after the time that sch4p4(6) Perso would have arrived at the Position 1 work area.

Time Hr/Min/Sec	CCTV	Event	Comment
04:12:35	Cam 1	CMWs observed walking from Water Truck towards the tyre fitters container	Both sch4p4(6) Perso and sch4p4(6) Perso agreed that they went together to obtain a replacement valve stem.
04:15:15	Cam 1	CMWs observed walking from the tyre fitters container towards the Water Truck	
04:15:33	Cam 1	CMW at the rear of the Water Truck walks to the air reticulation supply point. Then walks back around the rear of the Water Truck. This takes 18 seconds	
04:19:23	Cam 1	CMW at rear of Water Truck walks to the air reticulation supply point. Then walks back around the rear of the Water Truck. This takes 17 seconds.	
04:22:24	Cam 2	CMW seen walking across workshop in the direction of the workshop offices.	Supervisor sch4p4(6) Perso identified that this was himself during his second interview.
04:22:52	Cam 1	Bursts of exhaust are seen from the Tyre Handler.	
04:24:05	Cam 1	Tyre Handler moves back from Water Truck.	This movement of the Tyre Handler may be that the wheel is now on the hub and some of the wheel nuts are 'rattled on'.
04:24:36	Cam 2	CMW is observed walking in workshop.	Supervisor, sch4p4(6) Perso identified that this was himself during his second interview.
04:25:22	Cam 1	Rear Dump truck parks in workshop.	
04:25:36	Cam 1	CMW picks up wheel chock for Rear Dump.	sch4p4(6) Perso stated that he chocked the wheels for the Rear Dump Truck.
04:26:24	Cam 2	CMW seen walking across workshop in the direction of the workshop offices.	Supervisor, sch4p4(6) Perso identified that this was himself during his second interview.
04:28:15	Cam 2	CMW seen walking across workshop in the direction of the workshop offices.	The CMW was carrying a bag and water bottle and is believed to be the Rear Dump Truck driver.
04:38:28	Cam 1	Bright light and dust is seen at the Water Truck.	Catastrophic failure of Position 1 rim assembly and tyre has occurred.
04:38:43	Cam 2	CMW seen walking across workshop in the direction of the Water Truck.	Supervisor, sch4p4(6) Perso identified that this was himself during his second interview.
04:40:47	Cam 2	CMW seen running across workshop in the direction of the workshop offices.	Supervisor, sch4p4(6) Perso identified that this was himself during his second interview.

Time Hr/Min/Sec	CCTV	Event	Comment
04:42:29	Cam 1	CMW observed at rear of the Water Truck walking to the air reticulation supply point.	It is believed that this would have been when the damaged airline(s) may have been isolated.

Table 3: Position 1 Tyre Handling Sequence from CCTV footage

Appendix s.73 Irrelevant information

8. Investigation

8.1 Arrival on Site

On their arrival onsite at 1030 hours on 16 February 2015, Mines Inspector Sullivan and Authorised Officer Broadfoot were met by Site Senior Executive (SSE), sch4p4(6) Personal info Technical Services Manager sch4p4(6) Personal inforr Safety and Health Manager sch4p4(6) Perso sch4p4(6) Pers and Anglo-American legal representatives, sch4p4(6) Personal and sch4p4(6) Personal inf A meeting was then held with the salient points being:

- That all mining operations had been suspended by the SSE across the site and all non-essential personnel sent home. Security had been posted at several checkpoints about the site
- The police were in control of the scene of the incident at the Dawson South workshop
- Explanation of the primary information of the incident was done by sch4p4(6) Pers

Authorised Officer Broadfoot and Mines Inspector Sullivan were then accompanied to the Dawson South workshop at 1240 hours where they met PCC (Plain Clothes Constable), sch4p4(6) Personal who explained the police investigation progress, outlining the scene and identification marking points.

At approximately 1430 hours a meeting took place, at the request of the Inspectorate, with senior Dawson and Leighton Contractors staff regarding the Inspectorate's concern that notification of the next of kin may not have been done. This was over ten hours since the incident. At 1515 hours the control of the incident scene was passed from the QPS to the Mines Inspectorate. Inspector Sullivan informed the mine to maintain the same quarantined conditions as was already in place, and this was agreed.

Senior Mines Inspector (Mechanical), John Smith, arrived onsite from Brisbane at approximately 1630 hours on 16 February 2015.

At 1745 hours a debrief was conducted with Mines Inspector Sullivan, Authorised Officer Broadfoot, SSE sch4p4(6) sch4p4(6) Person their legal representative sch4p4(6) I and sch4p4(6) Pe and Mines Inspector, John Smith, of the day's events and the expectations of the Inspectorate regarding our requirements for the investigation.

A debrief meeting was held between the Inspectorate and the Industry Safety & Health Representative (ISHR) team to update them of the Inspectorate's strategy for the investigation. A number of meetings of this nature were conducted.

Senior Mines Inspector, Tilman Rasche, arrived on Tuesday, 17 February 2015.

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8.2 Mine Record Entries

The Mines Inspectorate has been periodically involved in tyre and rim related activities at Dawson. Activities have included:

- Questioning the scope and proposed changes to site tyre and rim management plans
- Querying training and competency requirements of persons involved in tyre fitting
- Inspection of facilities and housekeeping standards
- Investigation of Site Safety & Health Representatives (SSHR) concerns in relation to tyre and rim management
- Issuing directives to cease tyre and rim works until certain agreed actions have been undertaken.

The following table summarises activities and Mine Record Entries (MREs) undertaken by the Mines Inspectorate in relation to tyre fitting at Dawson Mine.

Name	MRE Date	Content
Mick McWilliam	5 Jan 2006	Comments in MRE regarding proposed site changes to Management of Wheels and Rims SOP, and incidents relating to tyre handlers.
Mark Moffatt & Mick McWilliam	24 Sep 2007	MRE includes specific details regarding s72a tyre and rim management and the existing site procedures, including competencies. The MRE noted that the plan is under review following the introduction of CAT 797B trucks.
Mark Moffatt	26 May 2010	MRE includes comments regarding acceptable housekeeping standards in the tyre bay and site follow-up on CAT 797B bead seat band cracking issues (note: there is a series of MREs relating to CAT 797 bead seat band cracking issues documented in 2008).
Mick McWilliam	11 Feb 2011	MRE responses in relation to Dawson SSHR site MRE relating to tyre management competencies.
Mick McWilliam	12 Jan 2012	Directive to suspend all tyre fitting tasks due to an unacceptable level of risk.
Mick McWilliam & Theo Kahl	13 Jan 2012	Investigation into tyre fitting practices; specifically related to the removal of 630E rear tyre whilst still inflated and without appropriate supervision.
Mick McWilliam & Anthony Logan	6 Aug 2013	Tyre fire follow-up.
Theo Kahl	13 Aug 2013	MRE mentions inspection of training management processes, tyre bay inspection and discussion of tyre bay competencies with respect to fitters.
Mick McWilliam & Bruce McKinnon	5 May 15 and 21 May 15	MRE details a SOP0012 tyre management audit: A directive issued for fall back arms to be fitted to tyre handlers and a request for an action plan to address issues identified in the audit.

Table 4: Summary of activities and MREs

In February 2011, a Dawson SSHR forwarded an MRE to the inspectorate which raised concerns about tyre fitting competencies, authorisations and the associated SOP. Mines inspectorate investigations confirmed that Dawson Mine was addressing issues identified in the SSHR's MRE.

8.3 Evidence

This investigation process consisted of an inspection of the scene of the incident, and the collection of evidence that led to an understanding of the cause of the incident, followed by site visits and further evidence collection when deemed appropriate by the investigating team. The visits to the site included:

- Initial visit on 16 February 2015 by the investigation team of Mines Inspector, Paul Sullivan, Authorised Officer, Andrew Broadfoot, and Senior Mines Inspector, John Smith
- Investigation of the incident site on the 17 February 2015 and 18 February 2015 by Mines Inspector Sullivan and Senior Mines Inspector Smith, Senior Mines Inspector, Tilman Rasche, and Authorised Officer Broadfoot (Appendix 22).
- Further investigation of water truck WT8006 by Mines Inspector Sullivan and Senior Mines Inspector Smith on 28 April 2015 (Appendix 23).

Over the course of the investigation evidence collection consisted of the following:

1. Taking videos, photographs and measurements
2. Obtaining and reviewing site documentation.
3. Interviewing site personnel both at the mine site as well as other locations
4. Obtaining CCTV footage of the workshop and analysing same.
5. Obtaining information from suppliers of multi-piece rims (Topy Industries & Rimex)
6. Securing the lock ring, bead-seat band and big bore inflator involved in the incident.
7. Reviewing Site Safety and Health Representative's (SSHR) and Mines Inspector's MREs relating to tyre handling.

When conducting the initial inspection of the incident scene with the QPS, it was observed that Position 1 tyre, rim components, and associated tyre fitting tools, had been dispersed over a significant radius. Figure 7 shows a metal fitting, believed to be part of the Norbar assembly over 12 metres away from the truck.

Figure 7: Metal fitting, believed to be part of the Norbar Assembly (*taken by QPS prior to site release*).

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8.4 Multi-piece Rim Assemblies

How a multi-piece rim is assembled will assist in the understanding of how the rim components combine.

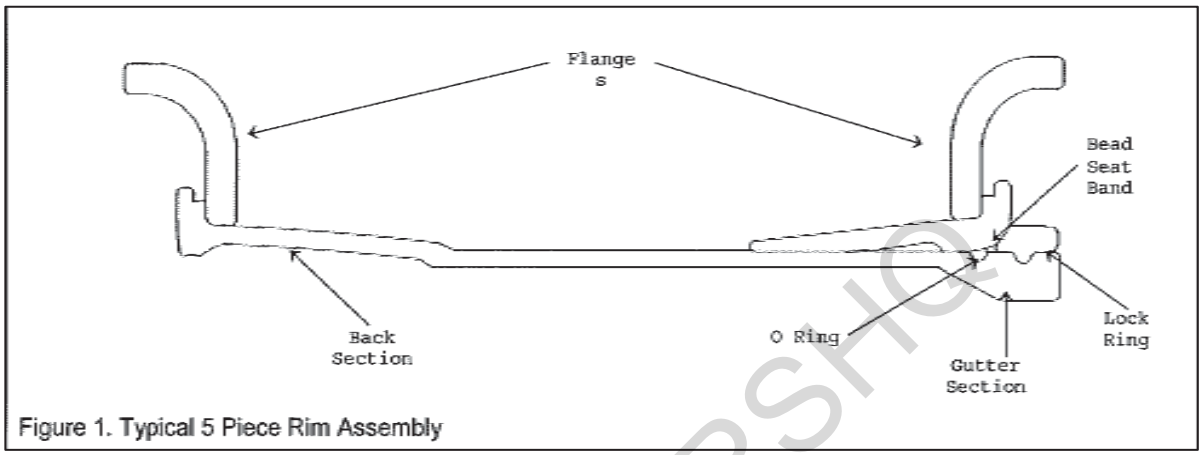

Figure 8: AS 4457.1 - Figure 1 - *Earth moving machinery - Off-the-road wheels, rims and tyres – Maintenance & Repair*

Figure 8 is a typical 5 piece rim assembly comprising of a rim base, flanges, bead seat band, 'O' ring and lock ring. The above assembly is similar to the construction of wheel that was involved in the incident.

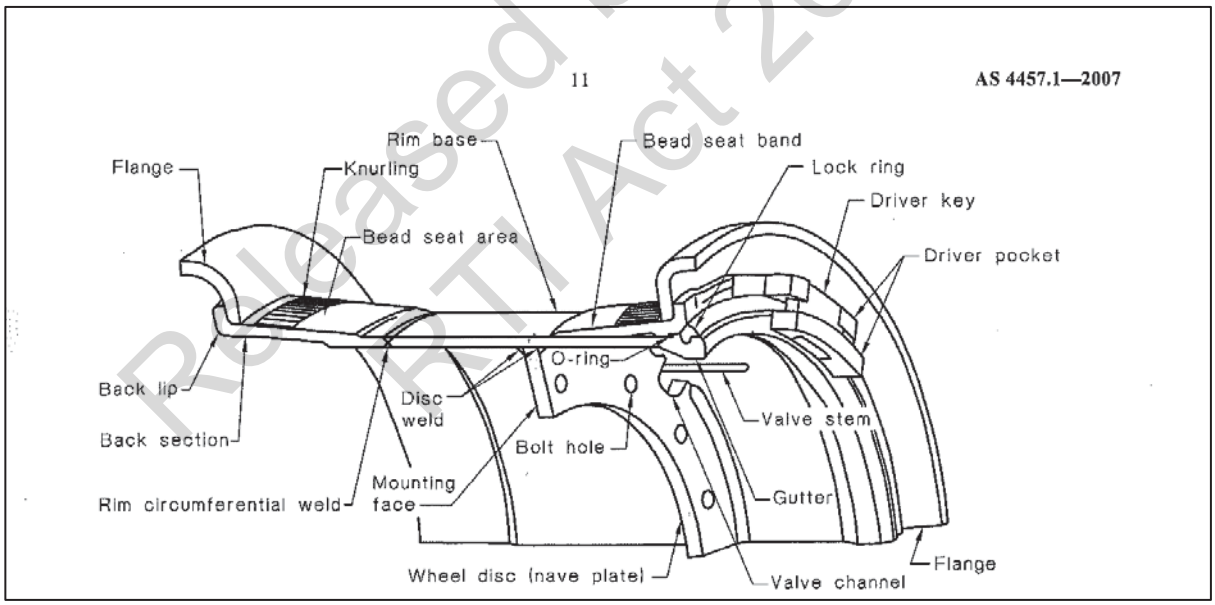

Figure 9: AS 4457.1 - Figure 2 - *Earth moving machinery - Off-the-road wheels, rims and tyres – Maintenance & Repair*

Figure 9 shows the nave plate mounted asymmetrically on the rim base. The offset from the nave plate to the edge of the rim, is greater on one side than the other. When in operation mode, the large offset protrudes over the drive hub. When in transport mode, the wheel is bolted to the rim 'back to front', which makes the wheel base wider so that the truck can be set down onto a low loader for relocation to another site.

Note that this diagram shows a 'Driver key and Driver pocket' and that the wheel involved in the incident did NOT include this device.

8.4.1 Lock rings and their General Requirements

When properly assembled and seated, the lock ring acts to retain the bead seat band and flange, so all components 'bind together' as the tyre inflates, and these components are applying force against the lock ring. A tyre inflated to over 100psi causes significant forces to act on the assembly. The failure of a lock ring, and the subsequent 'explosive' disassembly of the tyre and rim under these conditions, has caused catastrophic consequences including fatalities in the past. There have been incidents resulting in serious injury or death occurring with the failure of a lock ring.

Coronial inquests have been held for mining fatalities at Century Mine sch4p4(6) Per and Foxleigh Mine sch4p4(6) that involved lock rings.

There are different types and brands of lock rings and it is important the following critical aspects are identified:

1. Lock rings of a different type to the rim base and bead seat band assembly, may not be compatible as the profile of the lock ring and the lock ring groove may not match. There is also a statement in the Topy Industries Rim Instruction Manual (section 7.4), that even though the correct lock ring is used, if it is placed into the rim groove facing the wrong way, a failure of the lock ring under pressure could result (Appendix 24). Lock rings of a different type to the rim base and bead seat band assembly, may not be compatible as the profile of the lock ring and bead seat band contact faces may not match, eg. EV and EM contact faces are at 45 degrees to the rim base and ES are at 35 degrees to the rim base referenced in Topy Industries Rim Instruction Manual (section 7.3) (Appendix 25).

2. The Australian Standard AS4457.1-2007 (clause 3.1) states that 'Components associated with a wheel or rim assembly are not always interchangeable with other similar components'. The OEM Topy Industries Rim Instruction Manual has a statement (section 3.1), 'DO NOT combine rim components from different manufacturers' (Appendix 26).

3. The lock ring, bead seat band, lock ring groove and mating surfaces must be cleaned of all foreign material and contaminants. This is both to confirm that there is no damage to the components themselves, such as hairline cracking, and to ensure that the lock ring will seat fully home against all the components. Rimex Field Inspection Handbook (page 14), states that 'the lock ring is a consumable item and should be replaced after 5000 hours', as well as (page 18) 'Some styles of lock rings such as EV and EM should be considered throw away after a couple of uses as best practice' (Appendix 27).

4. Rimex Field Inspection Handbook (page 18) and Topy Industries Manual (sections 3.1, 8.1 - step 4 and 8.3 - step 5) state that lock rings should not be used if the ends of the lock ring do not touch as an unassembled component (Appendix 28). The lock ring is required to have sufficient tension so that it sits into the rim groove, and is in contact with the groove for the full 360 degrees, with the exception of the gap between the ends of the lock ring when assembled. It should be noted that both Topy Industries and Rimex do not clearly indicate how the confirmation of the overlap is to be checked. For example, if an EV lock ring is checked in the vertical position with the gap at '12 o'clock', there may be no overlap, however, if the gap is rolled around to the '9 o'clock' position, then due to the lock ring weight, an overlap of approximately 25mm can be observed. Figure 10 shows a 49 inch EV lock ring end overlap of 50mm when measured at the 9 o'clock position. Figure 11 shows the same 49 inch EV lock ring overlap of 25mm when measured at the 12 o'clock position.

Figure 10: 49 inch EV lock ring end overlap of 50mm measured at the 9 o'clock position (*taken by DNRM Inspectors at Rimex Mackay*).

Figure 11: 49 inch EV lock ring end overlap of 25mm measured at the 12 o'clock position (*taken by DNRM Inspectors at Rimex Mackay*).

Australian Standard AS4457.1 2007 'Earth-moving machinery: Off-the-road wheels rims and tyres – Maintenance and Repair' - Part 1: Wheel assemblies and rim assemblies

This standard refers to the requirement that '*for outer facing lock rings on the outer rim or wheel of a dual assembly, a lock ring retainer shall be fitted'* and a recommendation that '*lock ring retainers be fitted to all lock rings'.*

The Coroner's recommendations, Part 3 from the Findings of Inquest – Marshall – file COR-442/04(6) which stated, '*that the Mines Inspectorate, SIMTARS and industry participants continue with the revision of AS 4457 and that special attention be given to tyre handling, lock ring retention and rim maintenance'.*

Fitted to the water truck were 49 inch EV multi-piece rim assemblies which do not have lock ring retention.

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8.4.2 Bead Seat Bands and their General Requirements

The two images below, Figure 12 and Figure 13 show the profiles of the Topy multi-piece assembly EV rim (49 inch) rim, bead seat band and lock ring.

Figure 12 shows the bead seat band without the MMP ring (Surloc). The 13.23mm section above the lock ring profile (in Blue) is the 'shroud'. The manufacturer has stated that the shroud assists with controlling the coaxial alignment of the lock ring interface to the rim groove, when fitted correctly. If the lock ring is coaxially misaligned, the limited depth of the shroud may allow the tyre to pressurise, and may not prevent the lock ring from exiting the

lock ring groove during the initial inflation. Figure 13 shows the bead seat band with the Surloc ring. The manufacturer has stated that this ring is not a lock ring retention system. If the lock ring is not seated correctly in the rim groove, and is misaligned by greater than 1.9mm, then the leading edge of the Surloc will contact or bind against the back interface edge of the lock ring, and not allow the bead seat band to form a seal over the 'O'-ring, and will therefore prevent inflation.

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The shroud length on the Rimex bead seat band on Position 1 in the incident is measured at approximately 8mm, which is less than the 13.23mm of the Topy bead-seat band, and may allow inflation if the lock ring was displaced from the rim groove.

The Rimex 'Field Inspection Handbook' cites one example, where their components should not be interchanged with other OEM components. This is on page five of the Rimex 'Field Inspection Handbook' and states that the 'Rimex standard 63 inch HDT lock ring is not interchangeable with Cat OE 797 (Topy) 63inch lock rings' (Appendix 29).

Topy Industries 'Rim Instruction Manual' states: 'DO NOT combine rim components from different manufacturers' (Appendix 26).

Australian Standard AS4457.1 2007 'Earth-moving machinery: Off-the-road wheels rims and tyres – Maintenance and Repair', Section 3 REMOVAL AND INSTALLATION: Components shall be checked for compatibility prior to assembly. '*Components associated with a wheel or rim assembly are not always interchangeable with other similar components'*.

The above extract from the Australian Standard conveys the concern that different OEM components, whilst being of the same style, eg. EV or EM may have different design aspects and/or dimensions that may create a hazard.

Dawson's Standard Operating Procedure SOP 0012 Tyre Management states:
Section 6.4.1 Replacing Tyre & Rim Assembly - 'Before any assembly and inflation activities are conducted, components shall be checked to ensure they are compatible'.

As part of the investigation a number of tyre fitters at Dawson Mine were asked for their understanding of this statement. The anecdotal evidence suggests that there is compatibility if the components are of the same type. They did not consider the statement referred to different manufacturers components. The assessment for SOP0012 does not cover this point.

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8.5 Water Truck WT8006 and its Rim Assemblies

The water truck's six wheels were of the EV rim type. The rim components on Position 2 to Position 6 wheels were from the same manufacturer, Topy Industries. A visual inspection of these wheels indicates that the bead seat bands incorporated a Surloc welded to them.

Position 1 rim assembly was different to the other five wheels. Not all of the components were from Topy Industries, but were a combination of different manufacturer's components. Although from different manufacturers, the components were of the 49 inch EV type.

Component Type	Part Number	Manufacturer
Lock ring	LR49EV	Topy Industries
Bead Seat Band	RMX 200 049	Rimex
Rim	RM1949EVR	Topy Industries

Table 5: Rim assembly components

The Rimex bead seat band on Position 1 does not have a Surloc ring welded to it.

8.5.1 The Incident Assembly Components

Tyre

The tyre is a new Bridgestone 2700R 49 earthmover. It was the correct size and type for a front wheel steer tyre. There was no failure of the tyre that contributed to the incident. Its part in the incident was as a pressure vessel that contained the energy that was suddenly released, causing the tyre and other rim components to become projectiles. Figure 14 shows the distance that it was ejected off the rim before it contacted the Tyre Handler. The skid mark on the ground begins close to the truck, and is where the tyre has made initial contact with the ground after leaving the rim. The skid mark continues until the tyre has fallen horizontally onto the ground. The initial trajectory from rim to ground is very short (less than a metre), where a fully inflated tyre would be at least several metres.

Figure 14: Distance tyre ejected before contacting Tyre Handler (*taken by QPS prior to site release*).

Rim

The Topy industries rim was manufactured in September 2005. The rim does show signs of general wear. When checking the rim groove with a rim profile gauge during the investigation, there did not appear to be any areas of excessive wear. Topy Industries do not supply information regarding an acceptable level of general wear. Figure 15 shows profile gauge checks done during the incident investigation. The maintenance history of the rim does not indicate that any substantial repairs had been undertaken on this component. This history indicates that the rim had been non-destructively tested (NDT) by an equipment supplier (Rimex) in November of 2010 (Appendix 30).

It is recommended by Rimex (Queensland Manager sch4p4(6) Persona that a rim NDT be conducted every two to three years, or every 10,000 to 15,000 hours on average, and more often if conditions are severe.

Figure 15: Profile gauge checks (*taken by DNRM at incident scene*).

Figure 16 shows that the rim had either not been cleaned as per assembly requirements listed in SOP0012 'Tyre Management' section 6.2, bullet point four, and Topy Industries 'Rim Instruction Manual' section 8.2, step two, and that if cleaning had occurred, it was to a less than adequate standard (Appendix 32). Position 1 nave plate had not been cleaned where the fasteners (nuts) were located. The gutter section at the bead seat band location had pale grey dirt marks where the bead seat band has rubbed the surface of the rim when ejected. It also has an older rust mark where a flange has been resting, and cracked paint in the same location. A wire brush would have removed most of these surface imperfections.

The cleaning of the rim is an important step that allows for:

- visual inspection - easier to see a precise fitment of the lock ring in the groove
- inspection for cracking or damage to the rim
- wear profile checks can be done correctly
- removal of lubricants in the lock ring groove (lubrication can ease displacement of a lock ring)

Figure 16: Standard of cleaning of rim (*from DNRM photos taken at incident scene*).

On 28 April 2015, Senior Mines Inspector, John Smith, and Mines Inspector, Paul Sullivan, attended Dawson Mine and observed the breakdown of the Position 2 rim assembly. This was done to determine the level of cleanliness of the assembled components, and as a comparison with the low level of cleaning of the Position 1 rim. It was also done to answer the question, was Position 1 typical of the standard of work sch4p4(6) Personal information sch4p4(6) Pe The observations of Position 2 showed that this rim had been cleaned to an acceptable standard.

There is damage to both the Position 1 and Position 2 rim components, and though some of this appears to have occurred during the incident, there is some damage that has occurred during the breakdown and assembly process, indicating less than adequate care when using the tyre handler.

Figure 17 below, shows damage to Position 2 assembly.

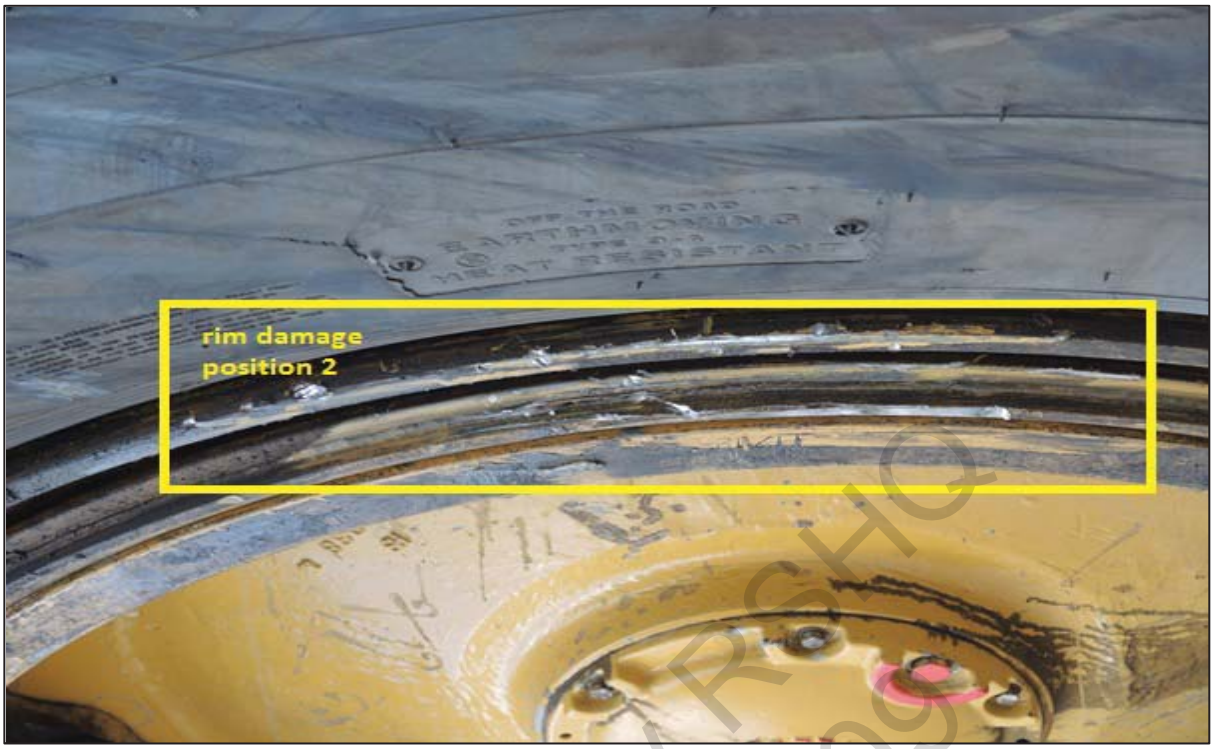

Figure 17: Damage to Position 2 assembly (*from DNRM photos taken at incident scene*).

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Lock ring

The lock ring in the incident was manufactured by Topy Industries and had been distorted due to the incident. Figure 18 shows the profile comparison to a new lock ring of the same part number.

Figure 18: Profile comparison to a new lock ring of the same part number (*from DNRM photos taken at incident scene*).

The lock ring was manufactured in February 2008. Topy Industries do not recommend that lock rings have non-destructive testing conducted on them, nor do they have any recommendation for the number of hours service that they should be used for before they should be replaced (Appendix 33). There are other OEMs who recommend that lock rings be replaced at 5000 hours, or after a couple of uses, and should be regarded as a consumable part (Appendix 34).

It is important to note, that witness marks left on the rim and bead seat band after the incident, may indicate that the gap in the lock ring ends when it was installed into the groove, was 38mm. Further testing is being conducted to determine if this measurement is indicative of the installation gap, which is the most probable reason, or that it could have been caused by the lock ring movement as it ejected from the rim groove. The OEM specifications state that the correct lock ring fitment should have a lock ring gap of between 16 and 27mm. With a deviation of this magnitude, there would be sections of the lock ring that will not have any contact, or less than adequate contact with the rim groove. Figure 19 shows the witness marks left on the rim by the lock ring.

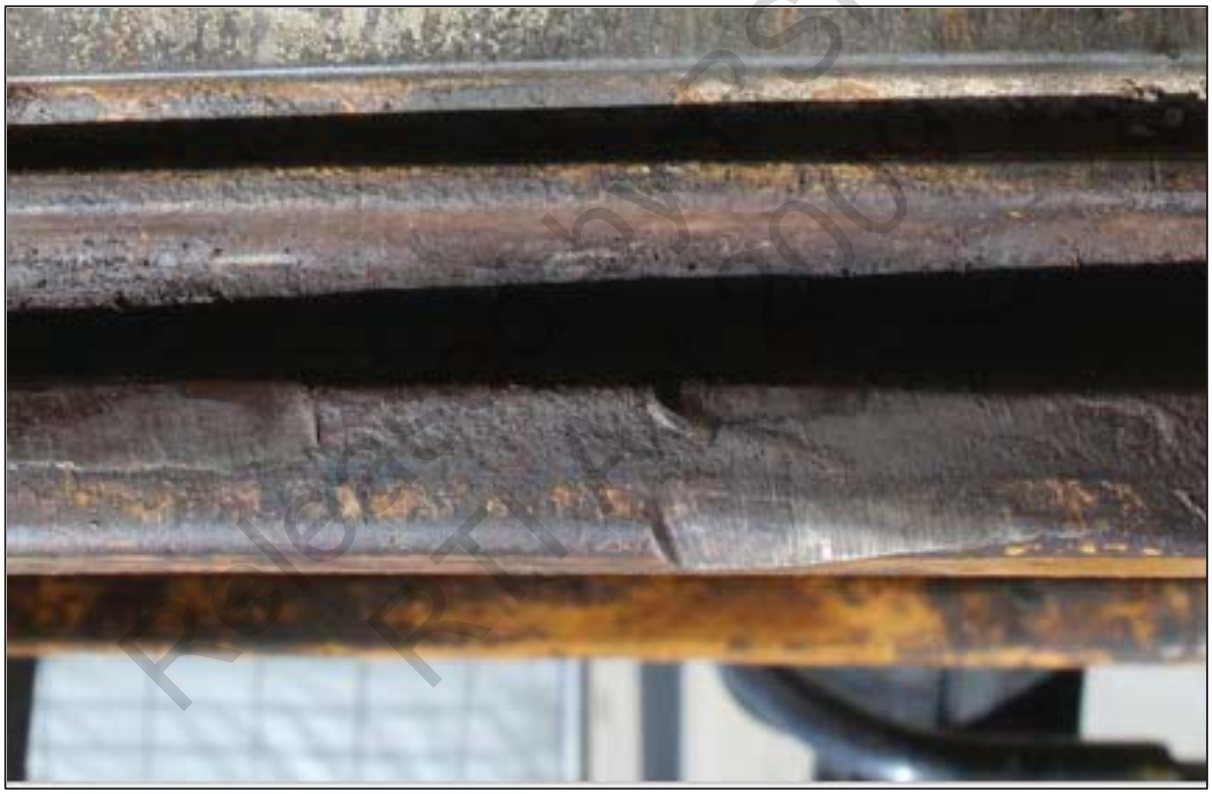

Figure 19: Witness marks left on rim by lock ring (*from DNRM photos taken at incident scene*).

The lock ring was poorly cleaned and was to a similar poor standard as the rim. The lock ring profile was visually inspected and did not appear to have any significant deviation in its dimensions from a new lock ring.

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Bead Seat Band

The bead seat band is a wide band of metal that slides over the gutter section of the rim, and it is the movable end of the gutter section. It supports the tyre bead creating an air seal and holds the flange against the side wall of the tyre. The inner face contacts the ‘O’ ring air seal and has a contact face with the lock ring.

The Rimex bead seat band was manufactured in September 2010 and shows signs of general wear. It was poorly cleaned and similar to the rim condition. Surface damage to the outer lip and scoring of the components was evident, and has mostly likely been caused during tyre fitting, when the Tyre Handler tyre grippers are compressing the tyre to allow fitting of the 'O' ring and lock ring, shown in Figure 20.

Figure 20: Rimex bead set band (*from DNRM photos taken at incident scene*).

Visual inspections of the three areas requiring critical review appear to be within tolerance (Appendix 35).

The marks shown in Figure 21 are the witness marks that occurred during the 'peeling' of the lock ring, that resulted in the explosive disassembly of the rim components in the incident. These marks match with those on the rim.

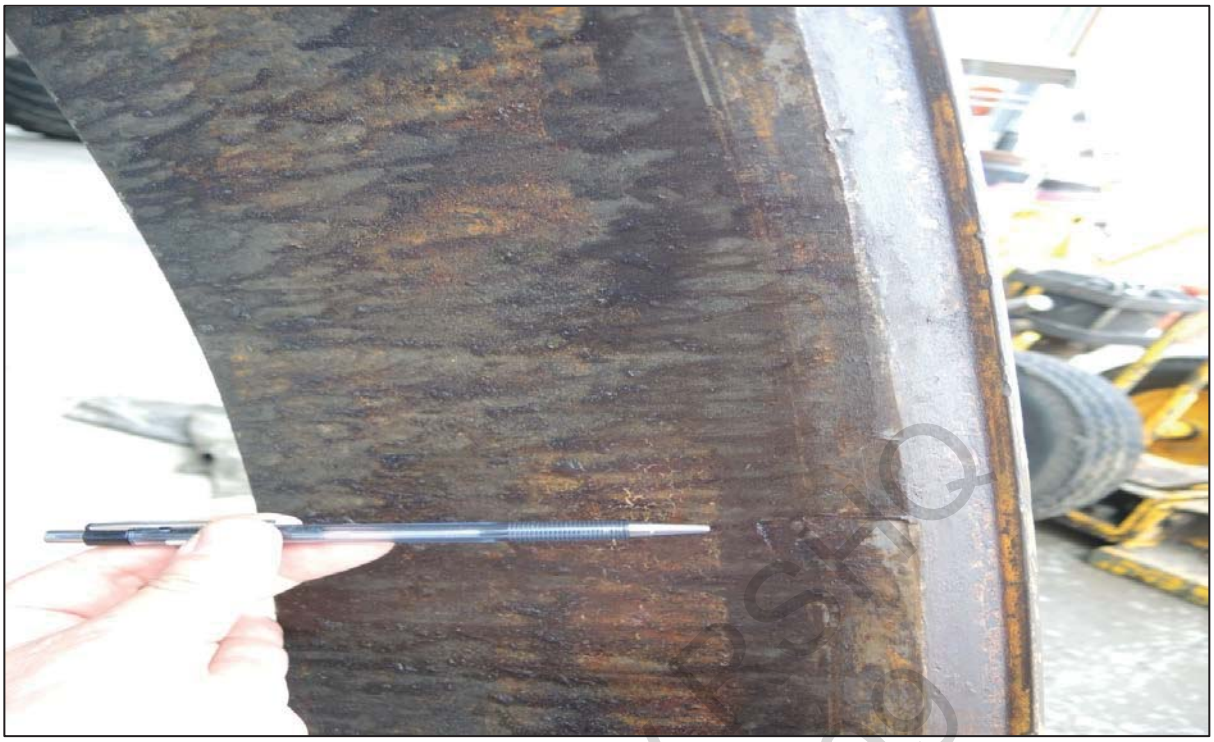

Figure 21: Witness marks that occurred during the peeling of the lock ring (*from DNRM photos taken at incident scene*).

Wheel Nuts

The nuts retaining the rim to the hub were torque tested during the investigation. Using the rim paint markings made by investigators, nut number 1 is the first nut clockwise from the 12 position. The torque values are listed below. Approximately 400 are typical of a rattle gun, and 900 is the Norbar setting torque. Appendix 35 - Rimex 'Inspection Guidelines for Wheels and Rims' page 16.

Nut position	Torque (Nm)
1	900
2	400
3	300
4	300
5	400
6	400
7	900
8	900
9	900
10	900
11	900
12	900
13	900
14	900
15	900
16	850
17	850
18	900
19	900
20	900

Table 6: Wheel nut positions and torques

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Dawson South Workshop and Equipment

Dawson South workshop is located approximately 100 metres from the Leighton Contractors administration block. The workshop has two bays under roof for truck and dozer maintenance, and a concrete pad next to the building where tyre handling is undertaken (Appendix 36). It also contains offices, warehouse sections for spare parts, and general work areas. In close proximity to the workshop is a 'Maintenance Igloo', which is a designated welding bay, as well as containing spare hoses, fittings, an electric overhead drill and a grinding wheel. There are also two 'sea containers' housing general spares.

Figure 22 shows Water Truck WT8006 on a concrete pad in the foreground of the photo. The Leighton Contractors administration building can be seen in the background of the workshop.

Figure 22: Shows Water Truck WT8006 in the foreground; the Dawson South Workshop with the administration buildings in the background (*taken by QPS prior to site release*).

The workshop services comprise of:

- Three phase and single phase power reticulation systems
- Potable water
- Communications systems, phone, computer (SCADA), CCTV cameras
- Compressed air
- Lighting.

Compressed Air

This system is reticulated around the workshop and is supplied from a Compair compressor with a Delcos 3100 control system that is set to an air pressure discharge of 126 psi. The air supply reticulation supply point that was use sch4p4(6) Personal information is shown in figures 23 and 24.

Figure 23: Air supply reticulation supply point (*taken by QPS prior to site release*).

Figure 24: Air supply reticulation supply point (*taken by QPS prior to site release*).

The two airlines are used for tyre inflation, as well as air supply for the pneumatic tools. There is a hose reel for pneumatic tools, and a one inch outlet for large bore tyre inflation, which is just out of shot in Figure 24. The one inch outlet has a 'T' section fitting which is connected to an isolation valve and a 'silencer'. This allows the tyre to be deflated through to the atmosphere in a controlled manner with adequate noise reduction.

This location is on the North East corner (reference direction only) of the workshop. Both the hose reel and the outlet can be isolated separately, with both these isolation points not having the ability to be readily locked out. The airline used to inflate the tyre was attached to a shut off valve and about 4 metres of airline terminating in the large bore inflator. At the time of the incident, the large bore inflator was attached to the valve stem on the rim, but has suffered subsequent damage as a result of the incident. As rim components and the tyre have been ejected from the water truck, the airline, large bore inflator and valve stem have been torn from the rim. The rim end of the valve stem has remained screwed onto the rim 'spud', but the flexible stem and valve end has remained attached to the large bore inflator. The ferrule that crimps the flexible stem to the rim end has not been located. Figures 25 and 26 show the two parts of the valve stem.

Figure 25: Part of the valve stem (*from DNRM photos taken at incident scene*).

Figure 26: Part of the valve stem (*from DNRM photos taken at incident scene*).

Lighting

The tyre bay area where tyre fitting activities were taking place is on an external concrete pad approximately 10 metres x 15 metres located on the eastern side (reference direction only) of the workshop. The general area lighting of this pad is provided by two fixed sodium vapour lights mounted on the eastern side of the building (refer Figure 27). It should be noted that the illumination from this lighting is significantly reduced to the area of the Position 1 wheel hub on the eastern side of the water truck, as the body of the water truck shadows this area.

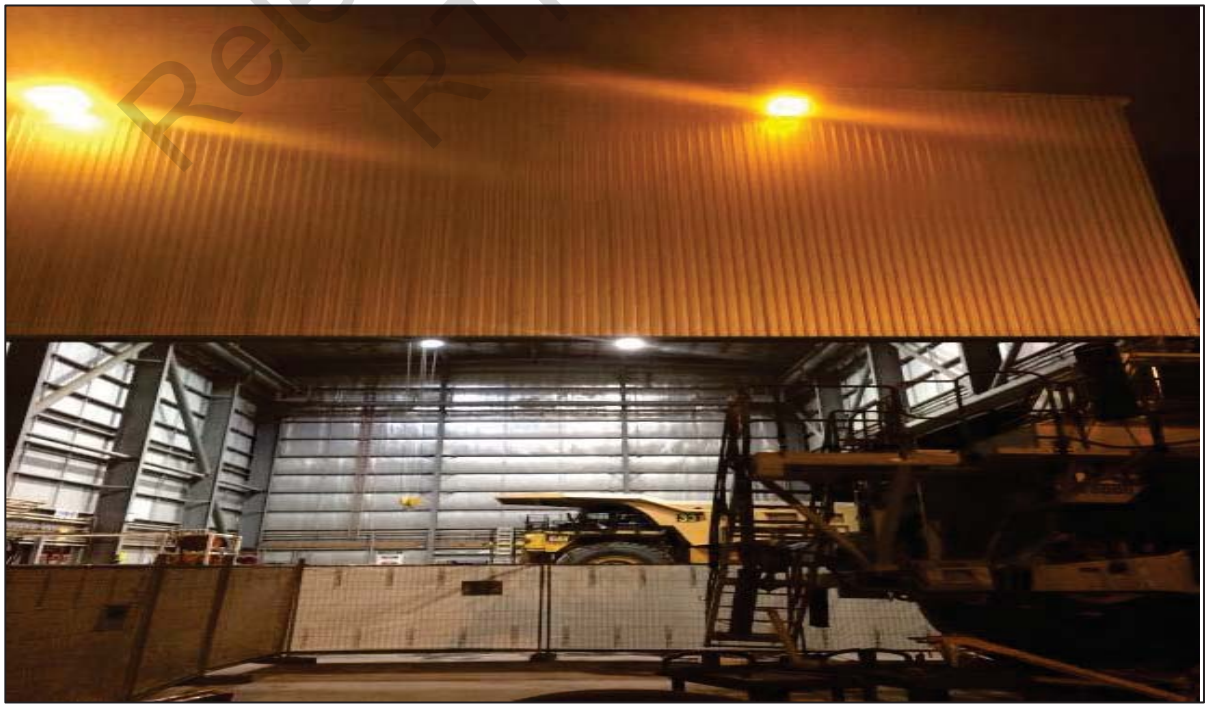

Figure 27: Fixed sodium vapour lights mounted on eastern side of building (*taken from Simtars Occupational Lighting Survey)* (Thiess)

Other sources of illumination in the area are a transportable lighting plant located further east approximately 30m away from where the water truck was parked for tyre work. This lighting plant is usually operating during the hours of darkness. There are several distant area lights, 50 – 100m away from the tyre bay area, which do not illuminate the tyre bay area to any significant degree.

The two other major sources of lighting are not part of the workshop and surrounds. These are the lighting from the Tyre Handler spotlights, and from personally worn adjustable battery operated cap lamps. Figure 28 shows the hat worn sch4p4(6) Personal info and figure 26 shows the Tyre Handler spotlights.

Figure 28: sch4p4(6) Personal inform (*taken by QPS prior to site release*).

Figure 29: Lighting from Tyre Handler (*taken from Simtars Occupational Lighting Survey*) (Thiess)

On the shift in which the incident occurred, the transportable lighting plant was not working after 1910 hours, and with the water truck in position at the tyre bay, the only lighting sources would have been from the Tyre Handler and personal cap lamps.

An Occupational Lighting Survey conducted by Simtars for Thiess on 17 March 2015, provides an overview of lux readings in the work area. It shows the lighting level in the work area where the wheel was stripped and rebuilt was very low, as shadowing from persons performing work, and shadowing from the water truck, would greatly affect the capability of the general lighting to provide sufficient illumination (Appendix 37). The illumination of the moon would not have been a factor. At the time of the Simtars lighting survey four weeks later, the moon was a thin crescent as it would have been on the night of the incident.

CCTV Cameras

There are four CCTV cameras that are located at the Dawson South Workshop and Administration Building:

1. Dawson South Camera 1 – located in the workshop and focusing on the doorway to the warehouse. It covers a view of the general walkway just outside the warehouse entrance, as well as some toolboxes and mounted spares buckets.
2. Dawson South Camera 2 – located in the workshop's warehouse and focusing out from the warehouse, through the entry door, and into the workshop towards the bay.
3. Dawson South Camera 3 – located in the workshop's warehouse and is focusing on the warehouse office and entry
4. Dawson South Carpark Camera 1 – located on the Administration building and focuses over the light vehicle parking area, and to the workshop truck and machine bay entries. It was from this camera that the significant amount of the timeline focusing on the work

done on Position 1 wheel was determined. Figure 30 shows a still shot from this camera. The water truck (circled) involved in the incident can be seen in the background on the north east corner of the building.

Figure 30: Dawson South Carpark Camera 1 still shot (*taken from CCTV footage*).

Norbar

At the time of the incident, sch4p4(6) Personal was in the process of tightening the wheel nuts to a tension of 900N/m. This was done by using a pneumatic torque multiplier, 'Norbar' model number 18033 (Appendix 39). Figure 31 shows the Norbar still in the position where it was being used when the incident occurred.

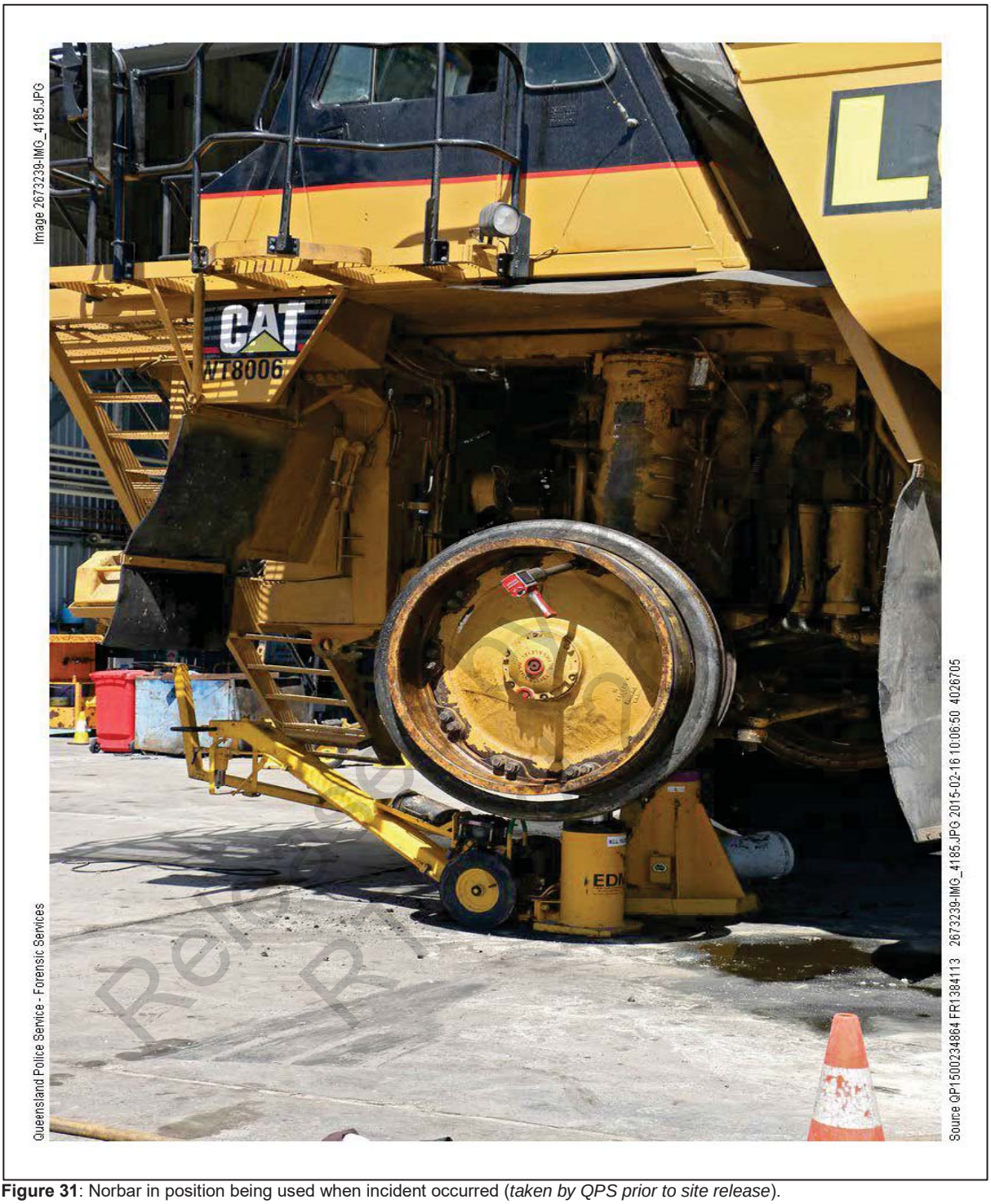

Figure 31: Norbar in position being used when incident occurred (*taken by QPS prior to site release*).

The airline was attached to the Norbar at the time of the incident, but has suffered subsequent damage as a result of the incident. As rim components, or tyre, have been ejected from the truck, the airline fitting in the Norbar was broken.

Figure 32 shows the broken fitting in the Norbar and the end of the airline.

Figure 32: Broken fitting in the Norbar and the end of the airline (*from DNRM photos taken at incident scene*).

The Norbar before use must be set to the torque required while using the workshop air supply pressure. Within the Leighton Contractors' management system, there is a form for recording the torque applied when tightening the wheel nuts (Form M0054- PD-480 Rev2).

Rattle gun

A pneumatic impact wrench is a socket wrench power tool designed to deliver high torque output, with minimal exertion by the user, by storing energy in a rotating mass, then delivering it suddenly to the output shaft. It cannot be set to a specific torque setting as per the Norbar, and is used to initially tension the wheel nuts to secure them. This tension is approximately 450N/m.

Tyre Handler

The Caterpillar 988F (plant number 6023) is a hydraulic front end loader manufactured by Caterpillar Inc. The 988F is rated at 430 horsepower and has a ground clearance of 0.5 metres, and a height to the top of the cab of 4.1 metres. The operator is required to climb a vertical ladder-way to reach the cabin. This size loader was chosen as a Tyre Handler as it has sufficient power to accept the tyre handler attachment, and lift a large earthmover wheel at approximately three metres in front of the loader.

The JEC Dual-Arm Tyre Handler is a hydraulic powered attachment to the loader that allows a tyre to be gripped by two clamps, and picked up, rotated (vertical through to horizontal range), and articulated all from the cab of the loader.

The Loader and Dual-Arm attachment are collectively referred to as the 'Tyre Handler' in industry and in this report. Figures 33 & 34 show the front and profile views of the Tyre Handler.

Figure 33: Front view of Tyre Handler (*taken by QPS prior to site release*).

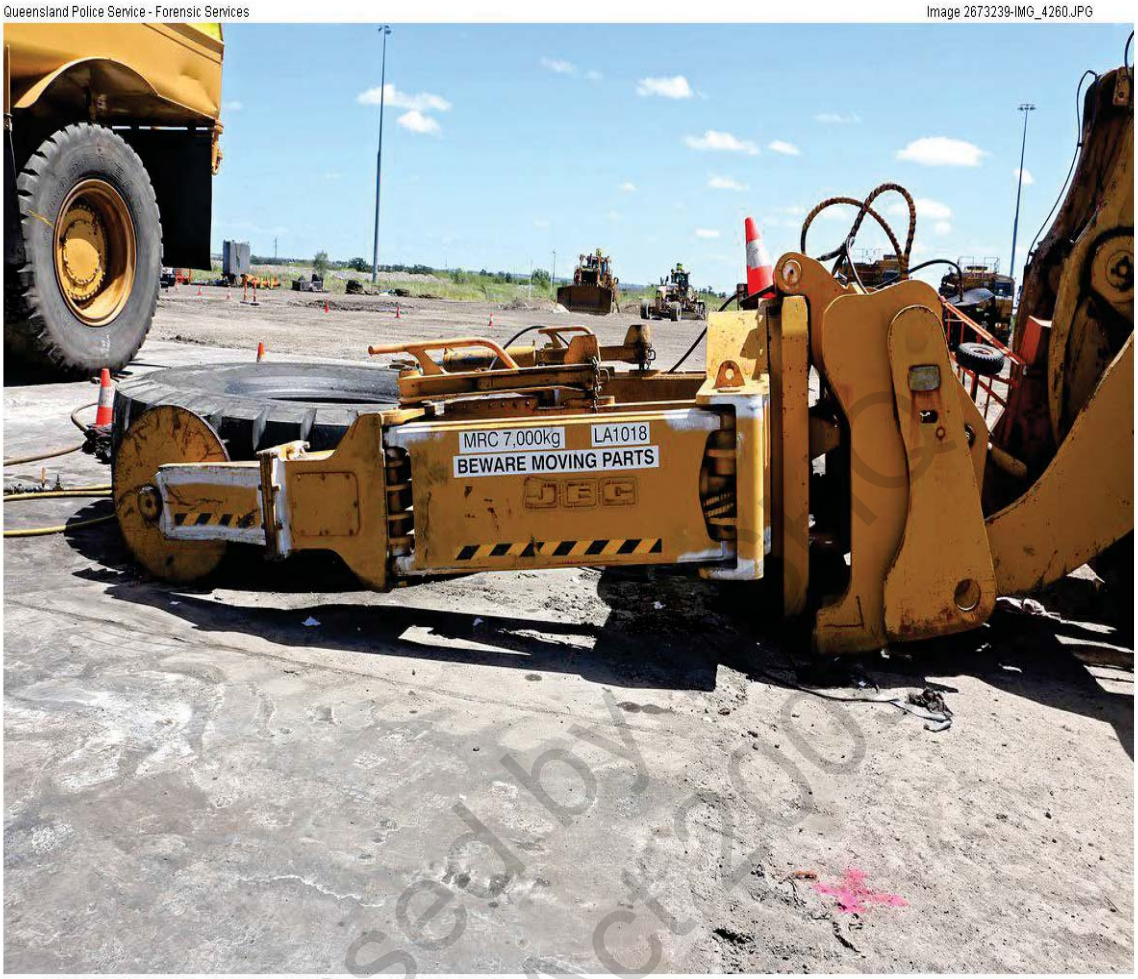

Figure 34: Profile view of Tyre Handler (*taken by QPS prior to site release*).

The water trucks wheel design weight is approximately 640 kilograms, and the tyre weight is approximately 1350 kilograms. These are well within the rating of the Tyre Handler.

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8.6 Lock ring Failure Analysis

A multi-piece rim is an assembly of interlocking parts held in place by the lock ring. If fitted and seated correctly, the lock ring cannot dislodge from the lock ring groove under pressure: the angled face of the bead seat band acting on the matching face of the lock ring causes the lock ring to be retained in the groove. However, if the lock ring is not fully seated, it is possible to dislodge the lock ring if the tyre is pressurised by the action of the bead seat band pushing the lock ring out of the groove.

Investigators marked the rim with numbers 1 to 12 as in a clock face - the rim in the position found after the incident has number 12 at the top. The nut with the Norbar still attached is nut number 1 (first nut clockwise from the 12 position). The investigation revealed that the nut tightening sequence appeared to begin with nut number 7 moving clockwise until reaching

nut number 1, fifteen nuts fully torqued. Five nuts at location numbers 2 to 6 were not fully torqued (refer Figure 35).

Figure 35: Five nuts at location numbers 2 to 6 (*from DNRM photos taken at incident scene*).

The rim has marks where the lock ring ends have been pushed off the rim. The marks show a gap of 38mm, which is an excessive gap. A lock ring fully seated in the groove would have a gap of approximately 20mm. If the ends are 38mm apart, then the lock ring is not seated. The ends would mostly likely be seated, the lock ring diametrically opposite is seated, but other positions of the ring will not be seated. The manufacturer's specifications state that the correct lock ring fitment should have a lock ring gap of between 16 and 27mm.

Further testing is being conducted by the Inspectorate to determine if this measurement is indicative of the installation gap. Figure 36 is a diagram showing an open lock ring (excessive gap end).

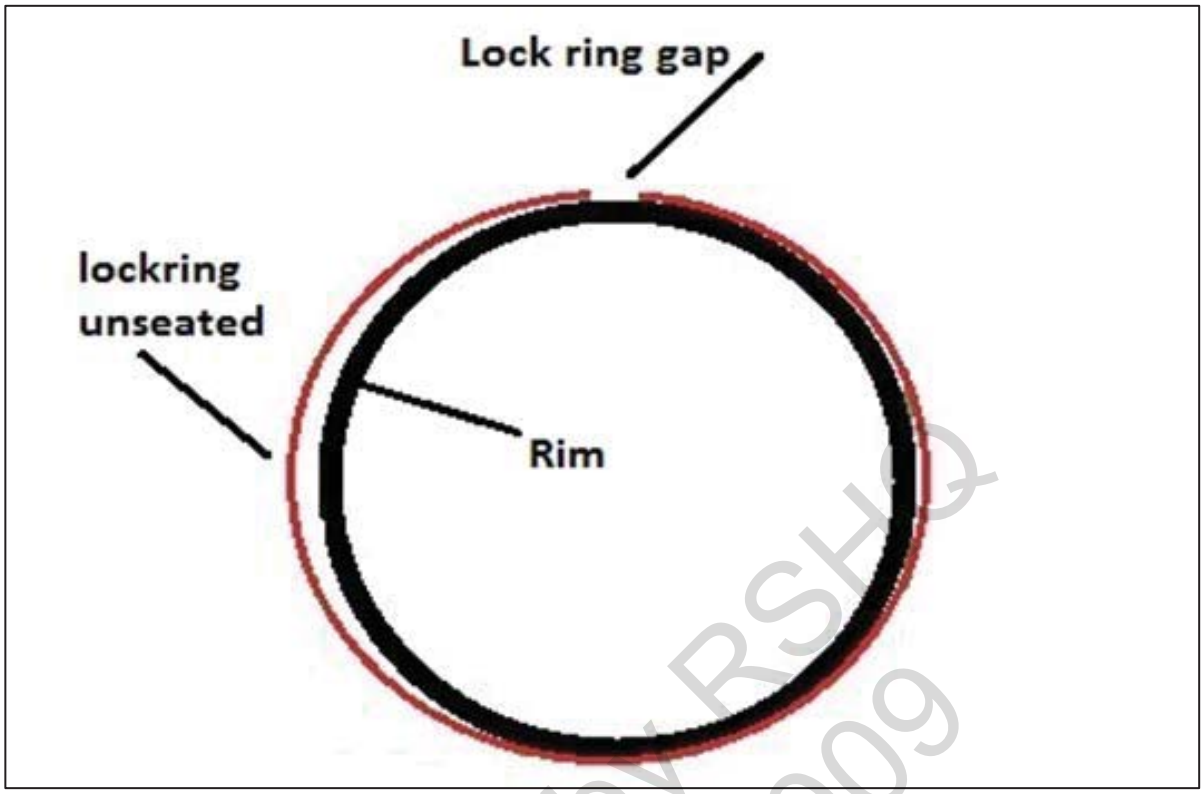

Figure 36: Diagram showing an open lock ring (excessive gap end).

The ends of the lock ring have left witness marks on the rim edge that show the metal edge of the rim has been extruded under great pressure. The most probable reason is that the two ends were the final part of the lock ring to be expelled from the lock ring groove. In other parts of the lock ring groove, there are witness marks that show a lesser force has pushed the lock ring out of the groove in a 'peeling' action. The next three figures following show some of these other marks.

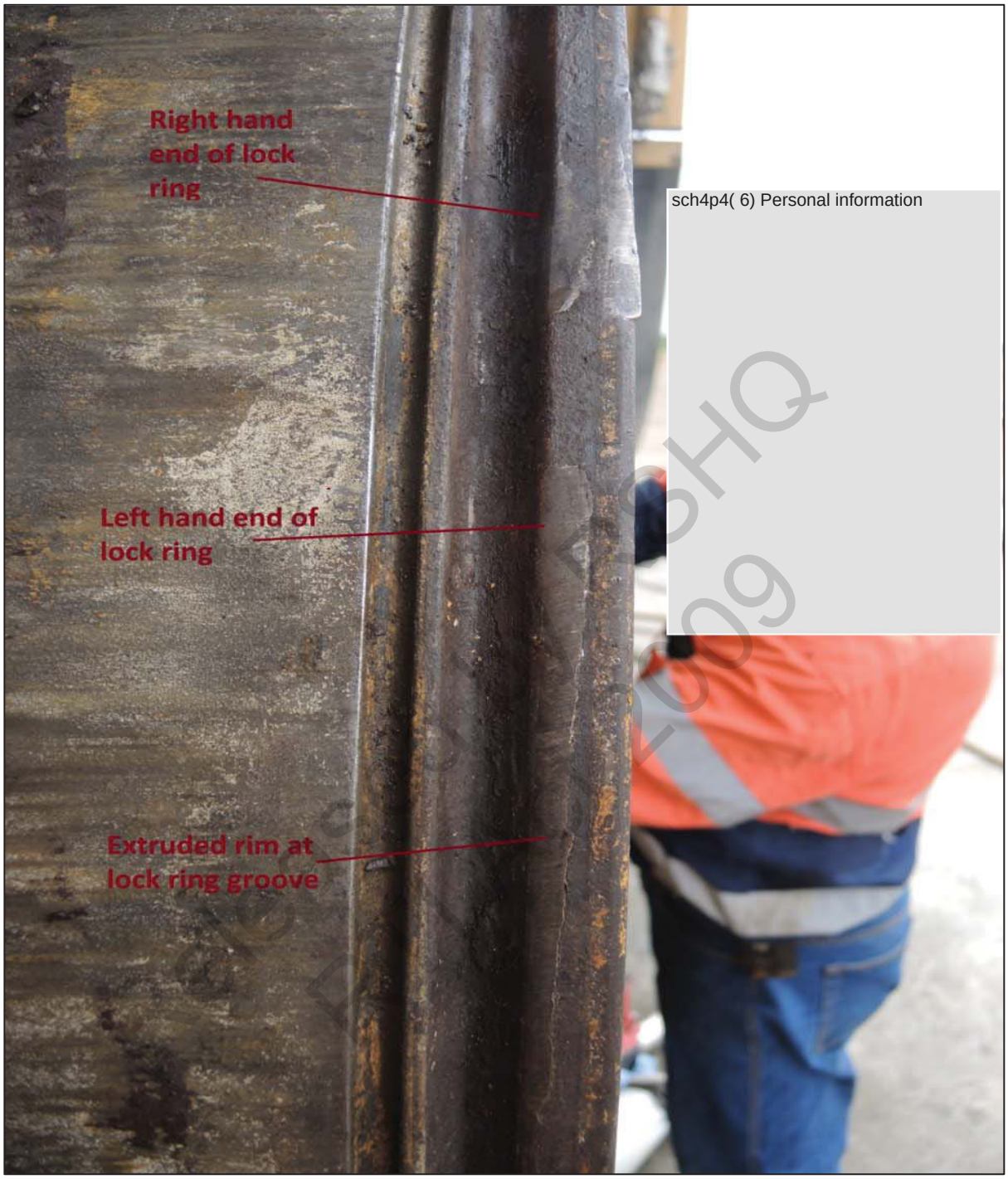

Figure 37: Right and left hand ends of lock ring and extruded rim at lock ring groove (*from DNRM photos taken at incident scene*).

Figure 38 and 39: Extrusion of rim (*from DNRM photos taken at incident scene*).

In Figure 40 below, the lock ring has a distinctive spiral shape, typical of a lock ring 'peeling' out of the lock ring groove.

Figure 40: Distinctive spiral shape of lock ring (*from DNRM photos taken at incident scene*).

The possibility of the lock ring being fitted in reverse was tested.

Figure 41 shows interference with the ‘O’ ring by the lock ring if fitted in reverse. Inflation of the tyre would not be possible as the bead seat band would not seal against the ‘O’ ring.

Figure 41: Interference with the ‘O’ ring by the lock ring if fitted in reverse (*from DNRM photos taken at incident scene*).

Simultaneously with the Mines Inspectorate investigation, the contract company Thiess (Leighton Contractors), was carrying out their own investigation. Their findings were shared with the Mines Inspectorate. Part of their investigation included a simulation. A new rim, bead seat band and lock ring were assembled and hydraulic jacks set around the circumference of the bead seat band to simulate pneumatic pressure in a tyre. The lock ring was held open with a gap of 38mm. As pressure was applied to the jacks, the lock ring began to ‘peel’ out of the groove (in the simulation this occurred around the 7 to 8 o’clock position). Examination of the rim afterwards showed very similar extrusion marks to those observed on the rim involved in the incident (Appendix 39).

Appendix s.73 Irrelevant information

8.7 Training, Competencies and Authorisations

It is a requirement under the Australian standard AS 4457.1 – 2007 that *'any operation within the scope of this Standard shall be performed by competent personnel following defined procedures'.*

Due to the considerable energy stored within an inflated tyre, OEM guidelines / rim instruction manuals, Dawson SOP0012 '*Tyre Management*', and the Australian Standards, require competent personnel to undertake tasks that are associated with tyre and rim assemblies.

Dawson SOP0012 lists the Resource and Industry Infrastructure competencies (RII) that would be required to become a competent and authorised person for the tasks of:

1. Fitting and Removing wheels and rim assemblies from heavy equipment – RIISAM210A
2. Fitting and Removing wheels and rim assemblies from medium, heavy rigid and multi combination equipment – RIISAM210A
3. Diagnosis, repair and maintenance of tyres on wheels and rims – RIISAM210A & RIISAM211B
4. Operate Tyre Handler - RIIMPO208A

The competencies above have been superseded since November 2013 by RIISAM210D, RIISAM211D and RIIPO208D respectively. The modification history states that apart from editorial comments, there are changes to the performance criteria, and substantial amendments to the assessment conditions. SOP0012 also states:

- That only an authorised, appointed person may undertake tasks associated with tyres and rims
- Trainees under structured training and authorised to work under limited supervision shall be permitted to carry out tasks associated with tyres and rims.

There is an exception to the above regarding assistance with manual lifting and the removal of all but four of the wheel nuts when removing a wheel (Appendix 31 Dawson Mine SOP0012 'Tyre Management', pages 9 and 26).

sch4p4(6) Personal information

sch4p4(6) Personal information

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8.8 Risk Assessment

There is a single Safety and Health Management System (SHMS) at Dawson Mine which includes Leighton Contractors' operation at Dawson South. There is a risk management system in place as part of that SHMS. The process comprises of a three tier system for the application of risk assessment:

- The Workplace Risk Assessment and Control (WRAC) for the project risks, change management and particular issues
- The Job Risk Analysis (JRA) for routine and non-routine task planning
- The Step Back Take 5 for the individual workers task and environment assessment of hazards. This tool is designed to encourage CMW's to consider the hazards in their workplace that have the potential to cause them harm prior to undertaking the intended work.

There is evidence that all of these methods are practiced at the mine. A Step Back Take Five is to be completed for each task to engender risk awareness into the natural decision making

of CMW's. A Step Back Take 5 is designed to be undertaken prior to each task to induce a CMW to consider what can go wrong. If used correctly it can create another barrier against an incident. The Step Back Take 5s that are done by crews throughout the day are handed in to the Crew Supervisor who reviews them before they are taken by the Safety department.

There was no evidence that sch4p4(6) Personal information had conducted a Step Back Take 5 assessment, or a JRA for the tasks they did on the day of the incident. A Step Back Take 5 had been completed by them for the previous shift (Appendix 8).

Supervisors either take part in the JRA process that is done by CMWs, or they review it prior to signing off on the JRA. It is only after the sign-off by a Supervisor that CMWs can sign onto the JRA to undertake the task.

In a statement made by Leighton Contractors' Maintenance Superintendent, sch4p4(6) Pe sch4p4(6) Pe approximately six weeks to two months before the incident, he put a stop to the generic JRAs that were done, as they were of poor quality. The JRAs were to be handwritten to encourage a focus on thinking about the task they were about to undertake. He expected that this would be done for '*doing jobs outside our normal jobs like lifting, or any high risk activities'.* sch4p4(6) Personal info was not included in the document flow process for completed JRAs before they were handed into the Safety department. In his second interview statement, sch4p4(6) Persona stated he was not familiar with any JRAs done by his or any other crew on tyre handling / fitting. There has been no evidence provided of any JRAs that have been done by this, or any other crew at Dawson South for tyre changing / handling.

8.9 Documentation

sch3(10)(3) Information compelled under investigation of contravention of the law

sch3(10)(3) Information compelled under investigation of contravention of the law

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8.10 Contractor Management

sch3(10)(3) Information compelled under investigation of contravention of the law

sch3(10)(3) Information compelled under investigation of contravention of the law

sch3(10)(3) Information compelled under investigation of contravention of the law

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8.11 Supervision

The Dawson SHMS – MOP004 'Management Structure' details Supervisor responsibilities that are quite extensive, and that the Maintenance Supervisors on 'A' and 'C' crew did not comply with all of the requirements (Appendix 52). sch4p4(6) Personal in C crew) allowed tyre handling activities to be undertaken by CMWs who did not have the competencies required by SOP0012. sch4p4(6) Personal i (A Crew) allowed tyre handling activities to be undertaken by CMWs who did not have the competencies required by SOP0012 and did not ensure that tasks were conducted in accordance with the Safety and Health Management System requirements (SOP0012).

From the interviews conducted with sch4p4(6) Personal and sch4p4(6) Personal infor they believed that tyre handling tasks could be conducted by CMWs who did not have any tyre fitting or handler competencies, as long as they were supervised by a person who was authorised and appointed to conduct tyre handling activities.

The Leighton Contractors Mining Safety Essentials – 10 Tyres, states as a minimum requirement - 10.1 '*Personnel engaged in tyre changing activities shall be authorised, or working under the direct supervision of an authorised person' (*Appendix 2).

sch4p4(6) Personal information

The supervision of the crew on the shift of the incident was:

- sch4p4(6) Personal was the appointed 'A' Crew Supervisor who has no tyre handling competencies, but has a familiarity with the process
- Leading Hand, sch4p4(6) Persona is an appointed Supervisor who has no tyre handling competencies, but has a familiarity with the process. sch4p4(6) Person describes his role as providing assistance to sch4p4(6) Personal

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8.12 Causal Analysis

The Incident Cause Analysis Method (ICAM) was utilised to analyse and summarise the information obtained during the investigation to determine latent conditions, active failures, and absent or failed defences that contributed to the accident.

Organisational Factors

PR- Procedures

- There was a Standard Operating Procedure available but no developed work instruction for tyre handling.
- Standard Operating Procedure did not identify sufficient controls
- Standard Operating Procedure requirements were not followed

TR- Training

- Standard Operating Procedure training less than adequate for high risk tasks.
- Competency of Supervisors less than adequate.

OR-Organisation

- Supervisor did not have competency to supervise task
- Insufficient resources / personnel for task
- OEM manuals were not available in the document management system

CO- Communication

- Inadequate communication regarding task. (Valve stem replacement)
- sch4p4(6) Personal did not attend shift handover meeting

RM-Risk Management

- sch4p4(6) Personal information did not complete a SLAM
- No risk assessment conducted for task.

Absent or Failed Defences

- Components allowed an unseated lock ring to become displaced
- No risk assessment conducted for task
- Inadequate supervision allowed violations to occur
- No work instruction for task. Critical stages not highlighted
- sch4p4(6) Personal was not competent for the tasks being conducted
- Lighting tower stopped and was not restarted

Task/Environmental Conditions

- Positioning of lighting created shading for task
- Inexperienced worker conducting critical tasks
- Task allocation resulted in inexperienced worker conducting critical tasks
- sch4p4(6) Personal inphysical capabilities restricted his ability to inspect task
- Lock ring groove and lock ring were not cleaned adequately
- Standard Operating Procedure was not followed while conducting task.

Individual/ Team Actions

- No evidence tha sch4p4(6) Personal information completed a Step Back Take 5
- sch4p4(6) Personalwas the competent person for the task but spent most of the task operating the Tyre Handler
- sch4p4(6) Personal id not notice that the lock ring was not seated correctly when working on the wheel
- Inexperienced person assembled together the wheel
- Inexperienced person cleaned the rim components
- No evidence of checks conducted to ensure all components were from the same OEM and were fit for purpose
- sch4p4(6) Personaldid not adequately supervise the tyre handling task
- sch4p4(6) Personalwas in the Tyre Handler when sch4p4(6) Personalwas conducting critical tasks.

9. Findings

9.1 Contributing Factors

- sch4p4(6) Personal installed a lock ring onto Position 1 wheel that was not seated correctly in the groove of the rim, or had become partially dislodged before or during fitment of the wheel to the truck. This caused the lock ring to come out of the groove, which allowed the pressure in the tyre to expel the tyre and rim assembly components off the rim base.
- sch4p4(6) Personal id not hold a tyre handling / fitting competency. sch4p4(6) Personal was the only person with a competency on the crew to undertake tyre handling tasks. There were an insufficient number of competent personnel on the crew to undertake tyre handling tasks.
- The lock ring may not have been installed correctly due to the correct fitment process not being followed. The critical aspects of this fitment are the seating and concentric alignment of the lock ring into the rim groove.
- There is evidence (witness marks on the groove section of the rim) that the lock ring had an excessive gap between the ends (38mm) when the lock ring was forced from the rim. The implication of this excessive gap is that the lock ring cannot have been seated correctly.
- The profile of the Rimex bead seat band has a shroud that is approximately 5mm less in thickness than the Topy Industries bead seat band. This can allow a greater tolerance of a lock ring not being seated correctly.
- The bead seat band did not have a MMP (Surloc) ring welded to it. This important engineering control can contribute to preventing inflation when the lock ring is not correctly seated.

- SOP0012 ‘Tyre Management’ was not complied with by the contractor Leighton Contractors. The competencies and authorisations required by this standard to undertake tyre handling tasks were not followed.
- SOP0012 ‘Tyre Management’ did not contain sufficient instruction for tyre fitting and handling tasks.
- Dawson Mine had not developed any safe work instructions or standard task instructions for the tyre handling tasks.
- sch4p4(6) Personal remained in the Tyre Handler and would not have inspected the work being done by sch4p4(6) Personal t critical stages of the assembly.

9.2 Non- Contributing Factors

- sch4p4(6) Personal information had not isolated the water truck when they commenced work on Position 1 wheel.
- sch4p4(6) Personal id not have the competency to undertake the tyre handling task he performed.
- Less than adequate cleaning of the rim assembly components may have impeded the ability of the components to seat correctly. Lubrication properties of the contamination in the lock ring groove may have assisted lock ring dislodgement from the groove.
- The mobile lighting tower failure reduced the lighting level in the work area which may have impacted on sch4p4(6) Personal in ability to check the components assembled by sch4p4(6) sch4p4(6) Pers
- A JRA for tyre handling was probably not undertaken by sch4p4(6) Personal information on the day of the incident. A Step Back Take 5 could not be located, if one had been completed by sch4p4(6) Personal information

10. Conclusions

- The conclusion of the QPS is that this incident was an industrial accident.
- sch4p4(6) Personal information due to being struck by either the expelled rim assembly components, or the tyre of the wheel that he was installing onto Position 1 of water truck WT8006.
- sch4p4(6) Personal information
- The incident occurred due to the lock ring on Position 1 wheel being ejected from the rim groove while the tyre was pressurised, probably because the lock ring had not been fitted correctly.
- It is unknown whether the tyre was being pressurised during the process of torqueing the wheel nuts. The large bore inflator was attached with the valve retracted. Statements by sch4p4(6) Personal and sch4p4(6) Persona indicate it was not being inflated. The trigger for expulsion of the rim components is also unknown.
- The distance the tyre was ejected from the rim is indicative of it not being fully pressurised.
- The SOP0012 ‘Tyre Management’ was not followed and was deficient.
- Supervision of tyre management and CMWs was less than adequate.
- sch4p4(6) Personal information did not hold the competencies of a Tyre Fitter, nor were they under a structured training program.

11. Recommendations

It is recommended that:

- Demarcation zones denoting the estimated blast (No Go) zone are established for all tyre activities for pneumatic tyre handling:

  - that prevents unauthorised entry into the zone
  - that indicate to CMWs of possible entry into the zone

  No Go zones may be temporary indicators such as marker tape or reflective cones or permanently marked on the workshop floor.

The size and shape of the zone should reflect the size of the tyre and pressure it contains:

- A procedure be developed that includes specific hold points at the safety critical steps of the tyre and wheel assembly process. The procedure should include a ‘stop, inspect and sign off’ by another CMW who is competent and authorised to undertake the tyre fitting tasks
- Supervising personnel for tyre activities should possess a certificate of attendance at a tyre and rim safety awareness presentation
- A CMW in training should not be assisting with safety critical steps unless directly supervised in those tasks. Remote supervision is acceptable for the non-critical tasks
- Lighting levels for performing safety critical steps should exceed general lighting standards for workshops
- That wheel assembly manufacturers consider failsafe design for assembly in their design criteria. Manufacturers are to investigate the design of bead seat bands that both prevent inflation of the tyre if the lock ring is not correctly seated, and lock ring retention once assembled.

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Report approval

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