Safety bulletin

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Earthmover Tyre and Rim Safety

Tyres, rims and wheel assemblies are safety-critical items that must be maintained and used correctly to achieve acceptable levels of risk. Inadequate earthmover tyre and rim maintenance carries considerable inherent risk of personal injury and death, as confirmed through several tyre and rim-related fatalities in Australasia over the last few years.

This safety bulletin aims to revisit some of the key hazards, associated risks and known improvement strategies. Mining operators, contractors, maintenance providers, original equipment manufacturers (OEM), designers and suppliers of tyres and rims must ensure that effective safety and health management systems (SHMS) and processes managed by appropriate personnel are in place to achieve safety in tyre and rim management. This is required by mining legislation and supported by the recently revised Australian Standards:

- AS4457:1 2007 Earthmoving Machinery – Off the road wheels, rims and tyres – Maintenance and repair Part 1: Wheel assemblies and rim assemblies.
- AS4457:2 2008 Earthmoving Machinery – Off the road wheels, rims and tyres – Maintenance and repair Part 2: Tyres.

Following is a sample of key hazards, associated risks and information on known improvement strategies.

1. **Bursting or exploding tyres and disintegration of pressurised rim assemblies can kill.** Unsafe conditions such as tyre bubbles, 'hot' tyres, damage affecting the tyre integrity, incorrectly fitted or damaged lock rings or other rim components can lead to sudden violent disintegration of the tyre or rim assembly during operation or maintenance. All these conditions are known to have caused serious injury and deaths. To create a basic awareness, provide site induction and regular refresher training on tyre and rim-related hazards and corresponding expected safe behaviours to all employees.
2. **Poor training in tyre and rim maintenance will lead to unsafe situations.** Training and refresher training for onsite tyre servicemen and line supervision is required. Such training should only be provided by registered training organisations experienced in tyre and rim maintenance using approved training packages, i.e. MNCG 1031A and MNCG 1032A. Providers of tyre and rim maintenance and service to the minerals industry offsite ought to be trained to the same training standard.
3. **The disintegration of pressurised tyre and rim assemblies is often the main cause of fatalities to tyre servicemen.** Typical root causes and prevention include:
   a) Earthmover rims undergo punishing dynamic loading cycles during their operation that can result in metal fatigue and general deterioration of the assembly. The combination of compromised rim integrity, through fatigue or damage of components, and failure to deflate the tyre before removing the assembly, has led to several fatalities. A reliable non-destructive testing regime to identify fatigue and other deterioration in rims and rim components should be implemented. Deflation protocol, as detailed in AS4457:1 2007, must be incorporated into the site's SHMS.

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b) The history of rims and rim components currently in operation must be reliably established and compared to the OEM stipulated safe life. The integrity of rims and rim components that have exceeded their stipulated safe life must be established through appropriate testing regimes as a priority. Also, the maintenance management system should be able to track, accurately report and alert on rim testing status.

c) Mismatch and subsequent disintegration of rim components has led to several deaths. Clear and unique identification of rim components must be achieved to minimise incorrect assembly of components that can lead to compromised rim integrity.

d) Hazards from sprung lockring earthmover rim assembly systems should be recognised as they can eliminate hazards of poor rim and rim component integrity. Where practical, use intrinsically safer designs provided by some earthmover rim manufacturers.

e) Similarly, check the integrity of light vehicle rim systems including sprung lockring systems and 'split rims' fitted to personnel carriers, site ambulances and other non earthmoving equipment.

f) Damage and material fatigue of tyres – the maintenance management system ought to ensure that tyre wear and condition are assessed regularly by competent tyre service personnel. In this way, safe use criteria as specified by tyre manufacturers are not compromised.

4. **Human fatigue will lead to slips and lapses** - given the likely higher frequency of tyre and rim-related maintenance due to the ongoing tyre shortage, sufficient and competent human resources should be engaged in tyre and rim maintenance activities.

5. Mines should be aware that some **OEM rim designs** deliver relatively longer fatigue life, reducing the need to remove rims off vehicle hubs during routine tyre maintenance. Their use is encouraged as they reduce the exposure to several tyre maintenance and manual handling hazards.

6. **Tyre handling equipment** must be fit for purpose. Structural integrity and serviceability of tyre handling equipment can be achieved through appropriate inspections, structural examinations and preventative maintenance by competent maintenance personnel. Better education and specialised training of tyre servicemen in the use of tyre handling equipment will also assist in reducing tyre handling accidents, e.g. dropped tyres, rims and assemblies.

7. To comply with the legislative requirement to ensure that risk to workers is at an acceptable level, the mine's SHMS must ensure that any maintenance activity involving tyre and rim assemblies is appropriately captured in **risk-based site specific work procedures**, and is carried out only by authorised personnel competent in approved training programs. Particular emphasis must be given to **deflation and pressure reduction of tyre and rim assemblies** in accordance with AS4457:1 2007.

8. Other safety critical tasks such as vehicle isolation, chocking, jacking, supporting the vehicle, deflation and inflation, torqueing and re-torqueing must be in accordance with OEM recommendations and site conditions. Safe tyre handling practices and use of appropriate 'fit for purpose' tooling and equipment must be incorporated in **work procedures**.

9. OEM maintenance manuals, safety alerts and safety bulletins, and other available information on tyre and rim safety should be sourced to compile comprehensive and effective work procedures. These procedures should also take into account the hazard associated with heating of wheel fasteners which is known to cause pyrolysis; the decomposition of rubber through heat inside the tyre cavity; and subsequent violent explosion of the accumulated gases. Furthermore, potential heating of wheel assemblies due to other conditions, e.g. hot bearings, hot brakes, overheating wheel motors need to be addressed and managed through the mine's maintenance management system.

10. Provision and maintenance of **'tyre friendly' mine operating conditions** through road maintenance, supported by mine haulage designs and operational standards, and ongoing improvements to operator awareness, will assist in reducing tyre damaging conditions and enhance tyre and rim safety, as well as tyre performance.

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11. While preventive actions should be prioritised, the **mine's emergency preparedness** should also be challenged and tested for its effectiveness through simulated tyre and rim-related emergency scenarios covering suspected or actual hot tyres, tyre fires, pyrolysis events through contact with power lines or lightning strike and other events. In particular, the scenario should examine safe means of evacuation of the vehicle operator. A recent high potential incident at a NSW mine, where a dump truck was hit by lightning causing three of the six vehicle tyres to violently explode within minutes of the lightning strike, has again demonstrated the enormous potential for significant harm.
12. The re-introduction and use of **Bias Ply tyres** (often from new manufacturers in the earthmover tyre market), and the use of second-hand and repaired tyres has created a new set of hazards which must be effectively managed through the site's 'management of change' process. Importantly, issues of load carrying capacity and Tonne Kilometre Per Hour (TKPH) must be resolved in consultation with tyre specialists before such tyres are introduced into the operation.
13. Many of the issues discussed in this safety bulletin should also apply to **non earthmover tyre and rim assemblies** fitted to light vehicles, personnel carriers and buses, and other non earthmoving applications such as forklifts, cranes etc.

Despite the hazards generated through the global earthmover tyre shortage in a time of peak minerals production, substantial improvements in tyre life and tyre safety can be achieved. They can include a combination of sound earthmover tyre and rim management principles, based on dedicated inspections; a range of preventive tyre and rim maintenance actions; maintaining good operating conditions; improving operator tyre awareness and practices; and tyre and rim performance management.

Adoption and incorporation of the known improvement practices mentioned in this safety bulletin, as well as implementation of the recommendations contained in AS4457 Parts 1 and 2 into a mine's SHMS, and importantly, effective communication with all stakeholders, are fundamental to achieving a safer workplace.

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Please ensure all relevant people in your organisation receive a copy of this Safety bulletin. Any such advice supplied to site should reach those who require it, and it should also be placed on the mine notice boards.

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