

# ***Earthmover Tyre and Rim Related Accidents and Incidents***

## ***A State of the Art Review with Recommendations***

**ACARP C15046**



**Tilman Rasche, BE, MSc**



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# Presentation Menu

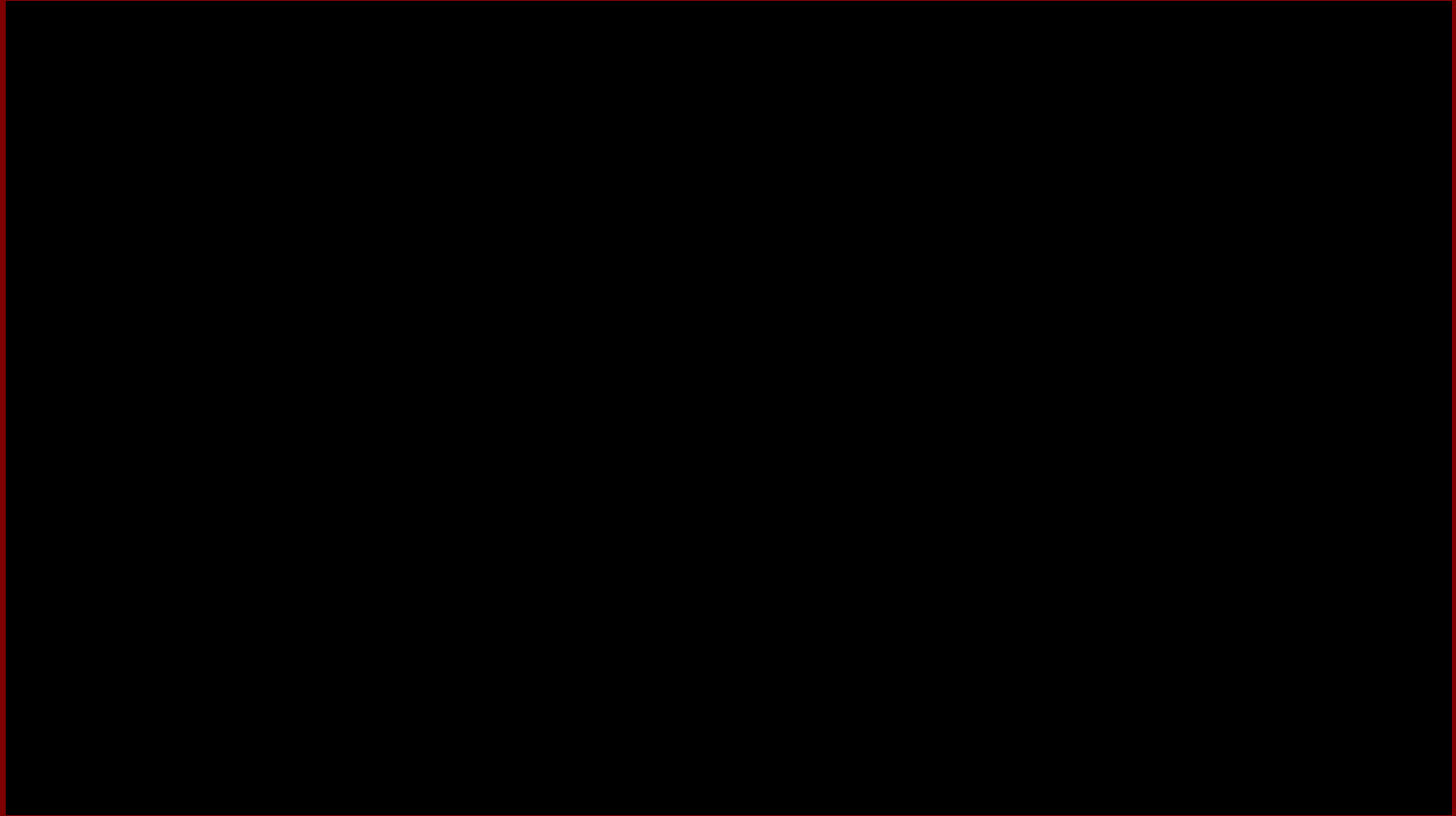
- Background
- Why?
- Data
- Analysis
- Findings & Recommendations
- Where to from here?



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# Exposure - Safety



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# Active Mining Truck Population is growing globally\*

Size Class	End 2003	End 2005	Change %
90 – 110 t	4983	6411	29
140 t	1726	2065	20
154 – 190 t	2937	3141	7
220 t	2349	2919	24
290 t plus	497	711	43
Total	12,492	15,247	22%

Global Growth = Tyre Shortage = Tyres are critical = more frequent tyre maintenance = Exposure = Risk

# Tyre and Rim Characteristics

- Flexible Pressure Vessel – dynamic loading
- Considerably higher inflation pressures
- ‘Failure’ of Tyre and or Rim can have catastrophic consequences
- Prone to ‘injury’ during operation
- Damage difficult to diagnose, not often visible from the outside
- Heavy & ungainly – (manual) handling risks specialised machinery to loadshift/manipulate



# Tyre and Rim Characteristics cont'

- Multi Component Rims – overall integrity
- Tyres (rubber) – composite construction - poor heat conductor - decomposition
- Rims (steel) - very good heat conductor
- Considerable fuel source
  - Difficult to combat tyre fire
- Specialist Maintenance (& training) – Tyres and Rims
- Tyre shortage – high frequency tyre maintenance - increased exposure - risk



# What about ...

- 2<sup>nd</sup> Hand tyres
- Repaired tyres
- 'New' compounds, untried types of tyres
- Limited choice of compounds
- Third party risks – latent conditions

Uncertainty  
& Risk





# Project Charter

- Project initiated by Klinge , following spate of fatalities in Austral-asian region – tyre shortage – tyre serviceman shortage
- ACARP funding granted
- BHP & XSTRATA industry monitors – Peter Cronin, Ron Groenland, Tony Egan



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# Data – 82 case studies, 19 years

All data in the public domain - www



Qld Government Department of Mines and Energy  
Department Mineral Resources New South Wales  
Department of Industry and Resources Western Australia  
Department of Consumer and Employment Protection Government of  
Western Australia  
National Occupational Health and Safety Commission  
Conference and workshop publications

United States Department of Labour Mine Safety and Health  
Administration (MSHA)  
Worksafe - British Columbia, Canada

## **Reports variable in detail and technical accuracy**

Safety Alerts, available from the Klinge Webpage – ‘Near miss’  
- ‘not reportable’ [www.klinge.com.au](http://www.klinge.com.au)

Note: Data ex industry incident databases found not specific  
enough to be included in analysis



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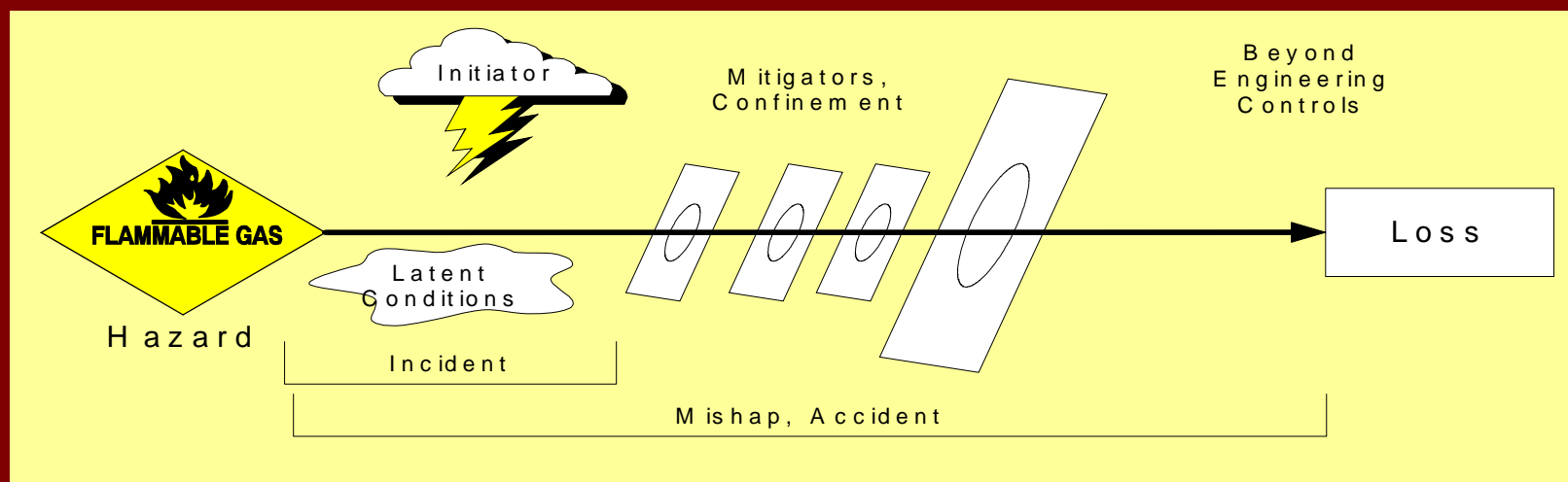
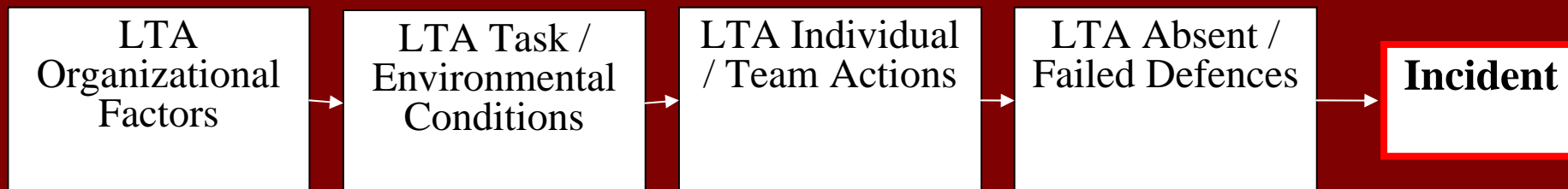
# ICAM Analysis

All incidents reanalysed

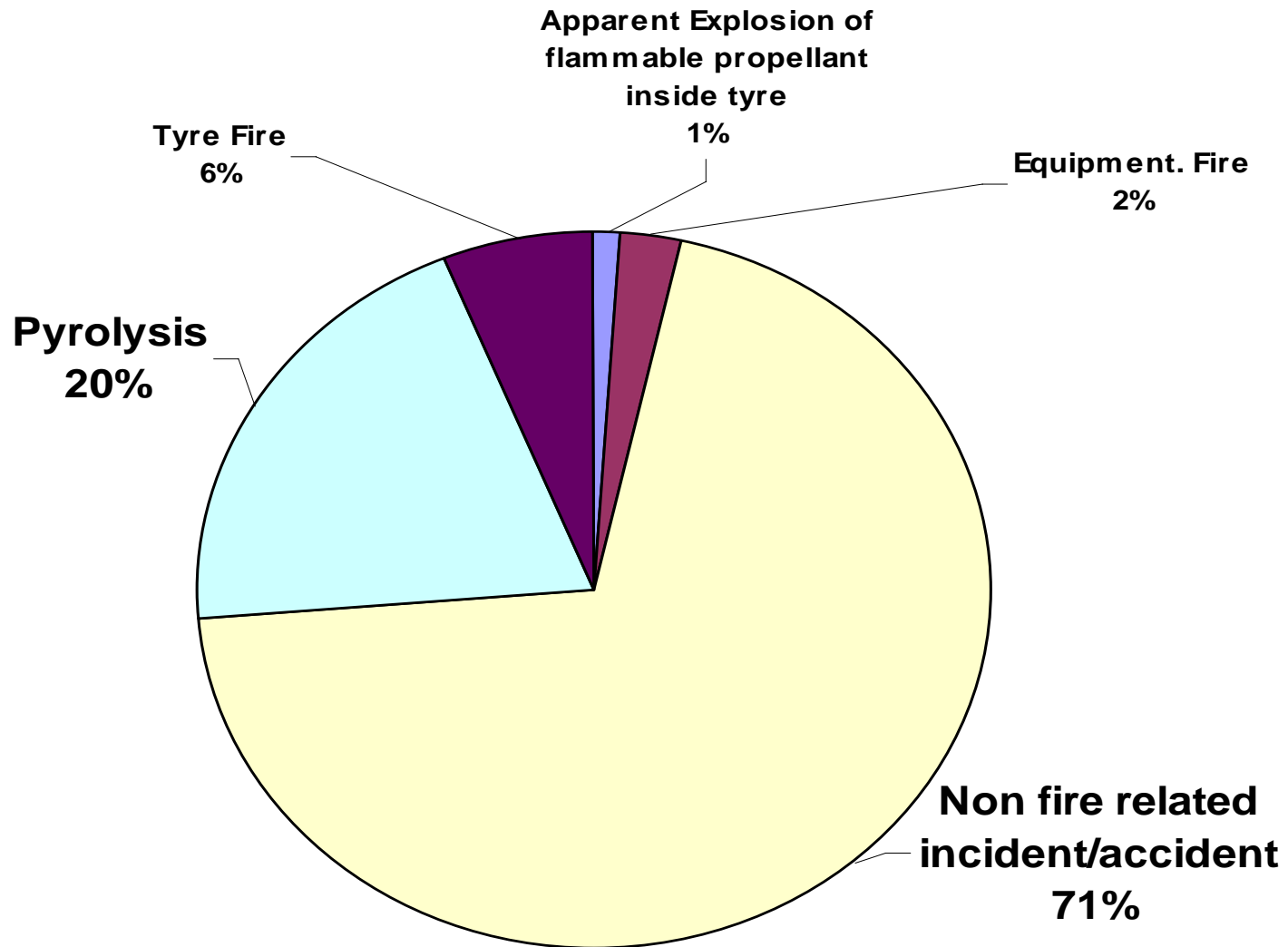
Tabulated - strict data taxonomy for analysis - ICAM

Consequences, Contributing and Root Causes, Prevention

Note: Obvious Bias towards 'notifiable' accidents as reporting requirement – by law



# Main Categories of Tyre & Rim Related Accidents



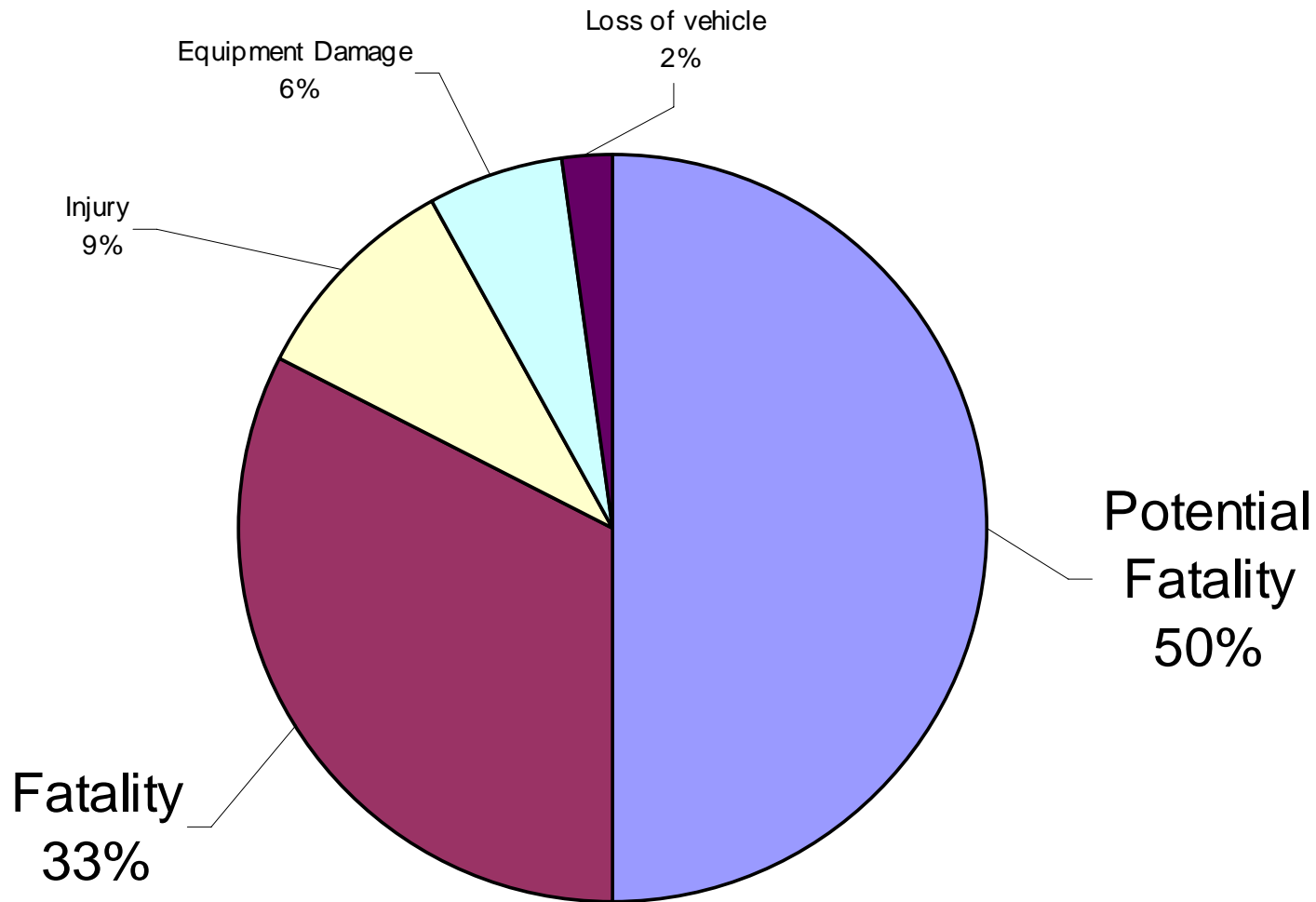
Sample size 82  
publicly  
available  
incidents &  
accidents



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# Consequences to Tyre & Rim Related Accidents



So what?

19 Years of data & 82 Incidents (at a minimum): this equates to ~ 4- 5 Inc/Acc per year, ~ 1 - 2 Fatalities/Yr. , ~ 3 - 4 pot. Fatalities/yr



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LTA Organizational Factors

LTA Task / Environmental Conditions

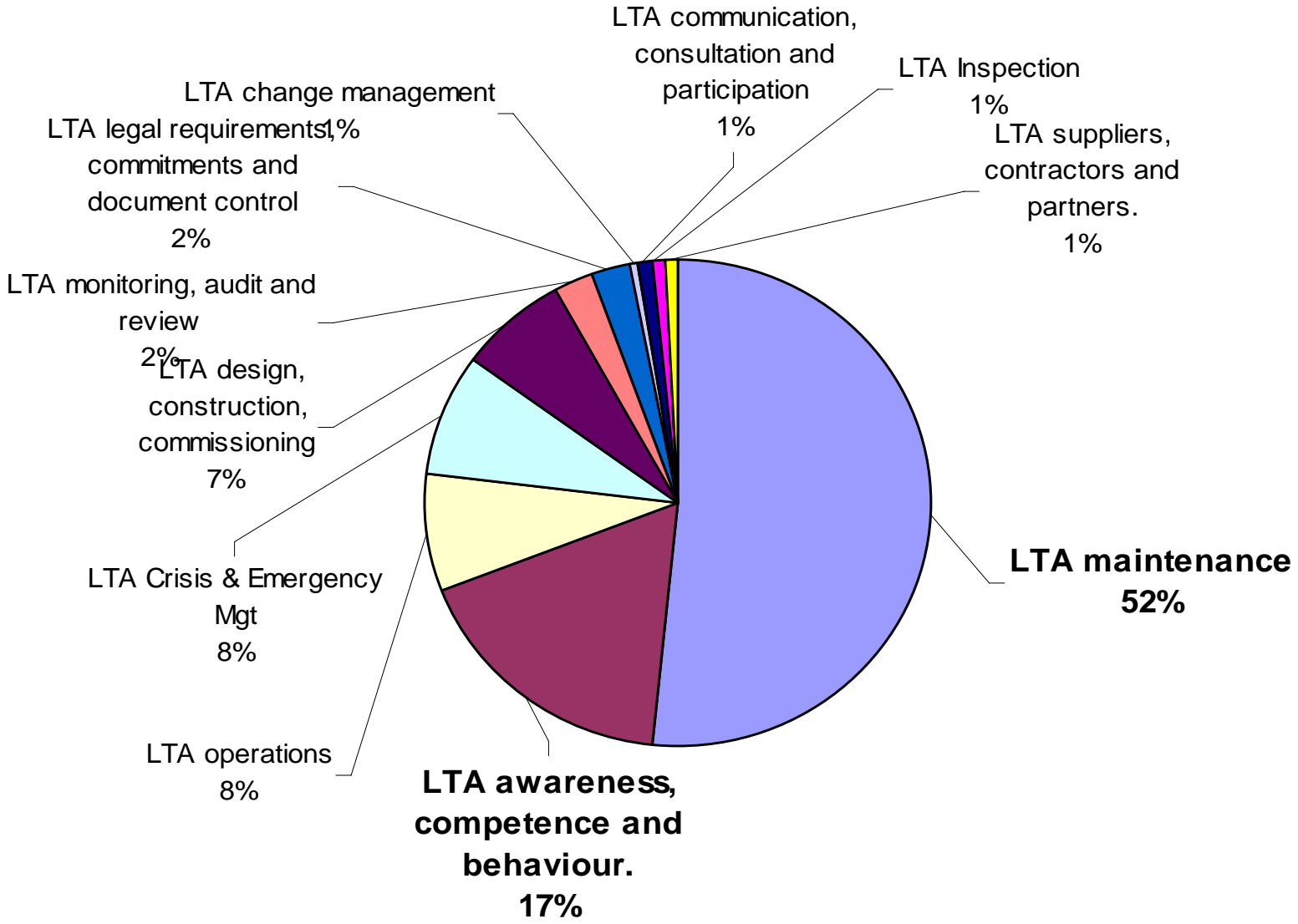
LTA Individual / Team Actions

LTA Absent / Failed Defences

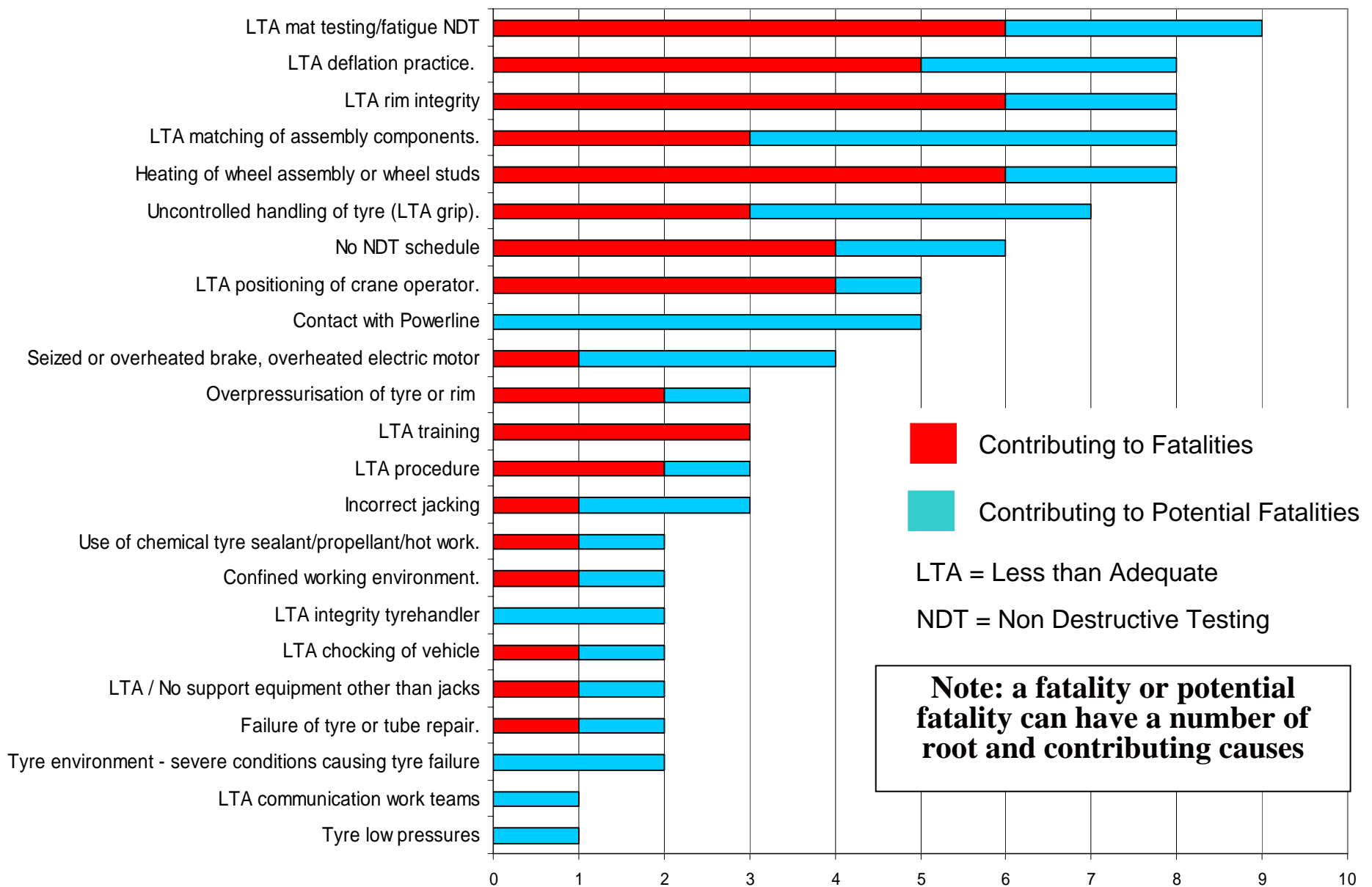
Incident

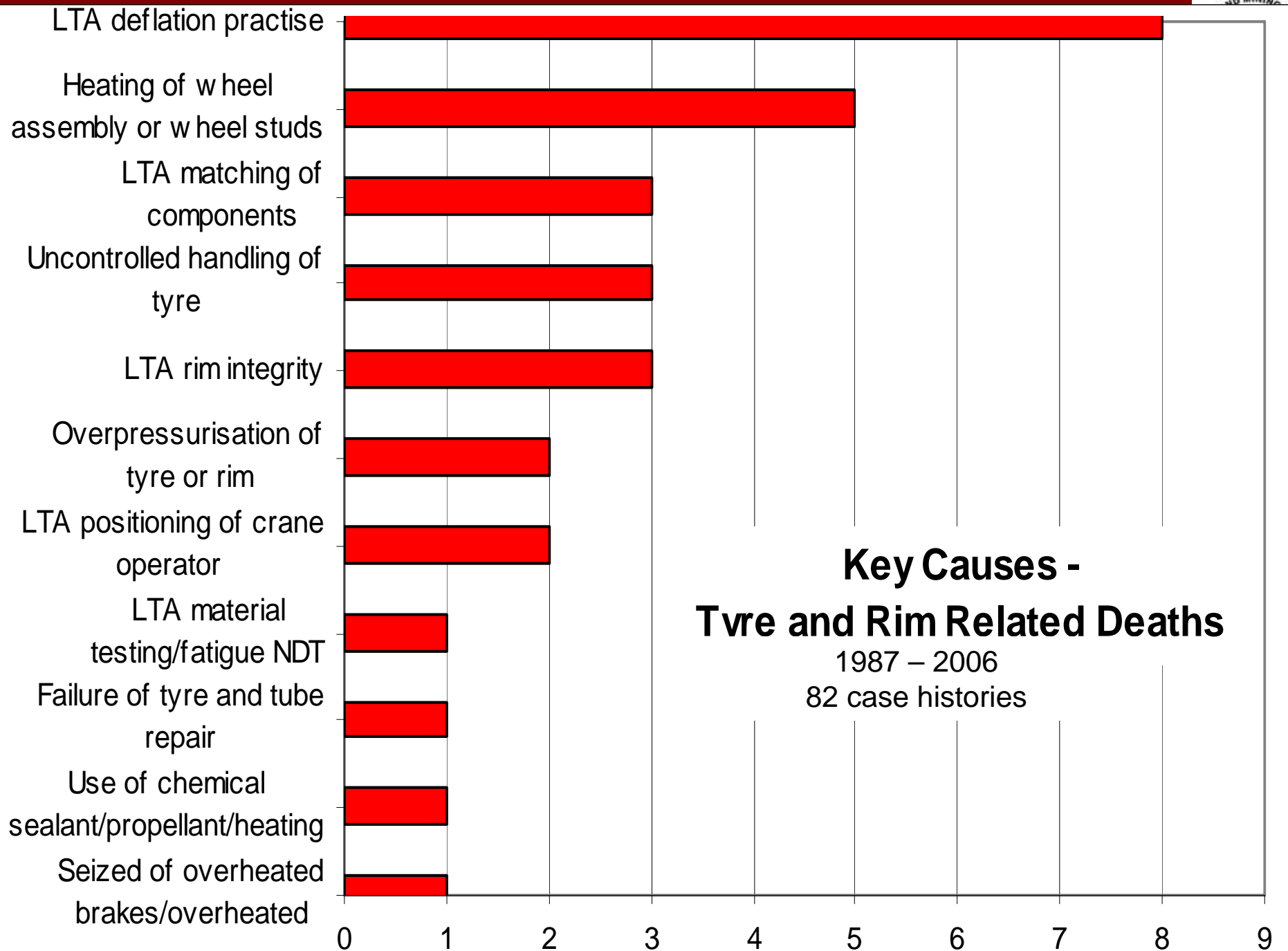


### Organisational Factors



# Root and Contributing Causes towards Tyre & Rim Related Deaths & Potential Fatalities, 1987 – 2006, 82 Case Histories





- Ohio News
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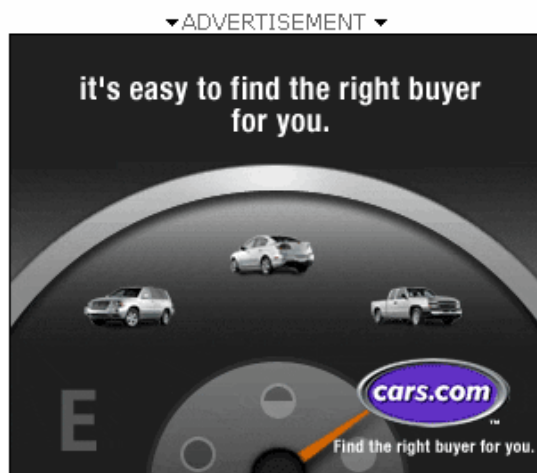
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## 1 worker killed, 1 injured while changing tire on large truck

Associated Press

MIDDLETOWN, Ohio — A contract worker at AK Steel was killed instantly and another man was injured while they were changing a tire that separated from the rim on a large truck and struck them, authorities said.

Both workers were experienced truck maintenance mechanics, said Jeff Beck, general manager of RMB Enterprises Inc., which employed the men.



tall when the accident occurred Saturday. The U.S. Occupational Safety and Health Administration is investigating.

RMB Enterprises, based in Fostoria in northwest Ohio, has a contract with AK Steel's Middletown Works in southwest Ohio to haul steel coils within the plant, AK spokesman Alan McCoy said.

The company makes flat-rolled carbon steel and stainless and electrical steel used in cars and appliances.

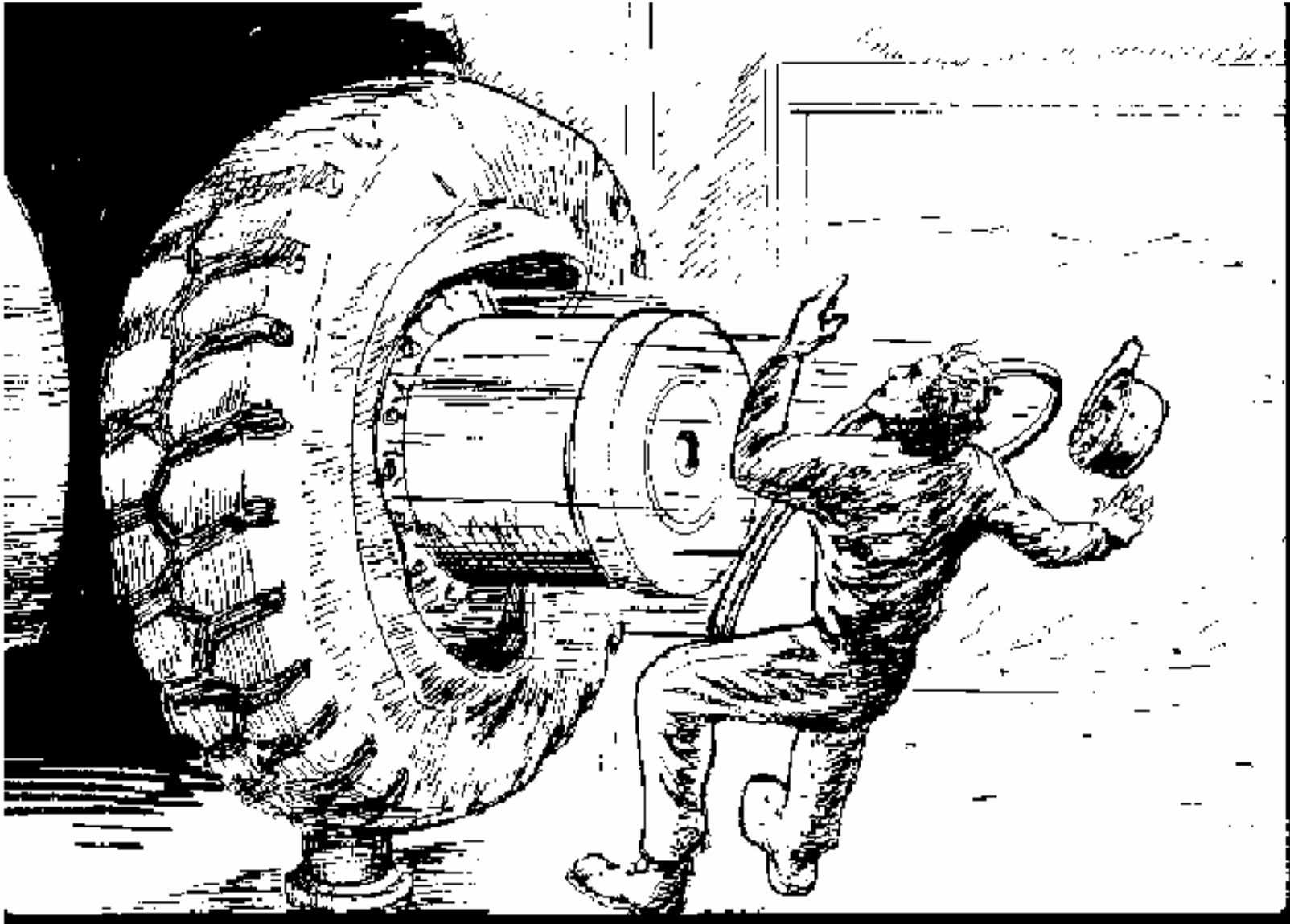
On Sunday, Beck identified the worker who died a day earlier as Rodolfo "Rudy" Guzman, 52, of Lebanon, an RMB employee for six years. Guzman, married with two children, had 20 years' experience in truck maintenance, Beck said.

Guzman was "the kind of loyal, dedicated employee you dream of hiring," Beck said. "He was a super guy."

The injured employee, Jon Roberts, 26, of Dayton, suffered a broken leg, Beck said. Roberts was listed in good condition Monday at Miami Valley Hospital in Dayton, a nursing supervisor said.

Beck said the men were changing a tire that was about 3 feet

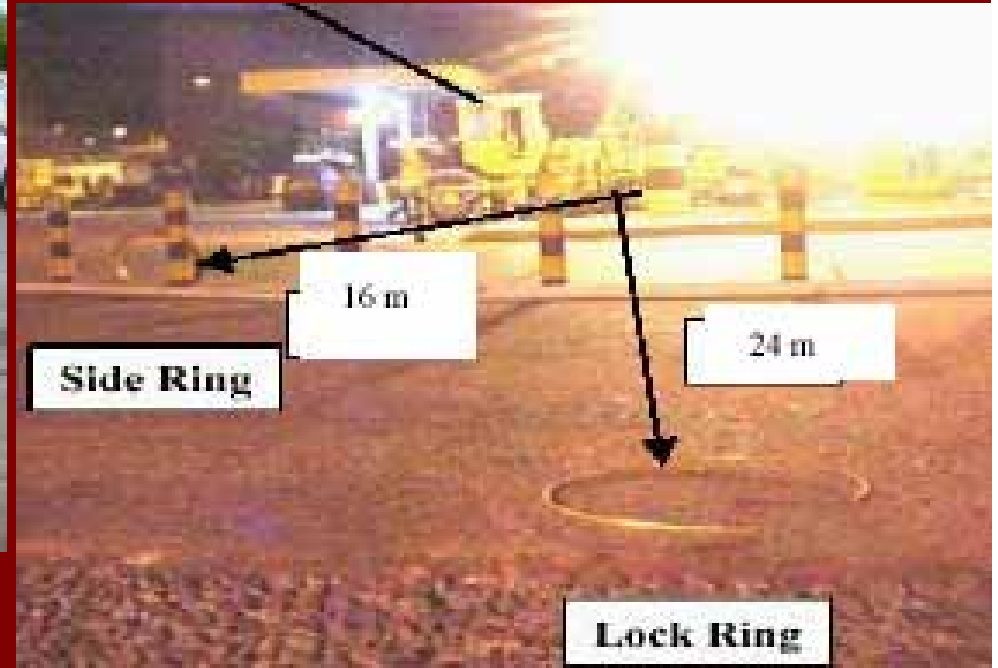




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# Incident & Accident Review cont'



Ex Industry Circular



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# Rim Fatigue



Legislative requirement for  
NDT testing AS4457

Not negotiable

# Incident & Accident Review



Ex WA Minesafe, Vol 11, Sept  
2000



Foreign Object –  
Omission & Latent  
Condition



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- Cleaning of tyre cavity prior to fitment mandatory –
- LTA Training or Awareness?

# Recommendations

- Industry induction - include specific tyre and rim awareness sections
- Tyre awareness sessions at site, seminars, workshops and conferences.
- Registered training programs.
- Design Improvements



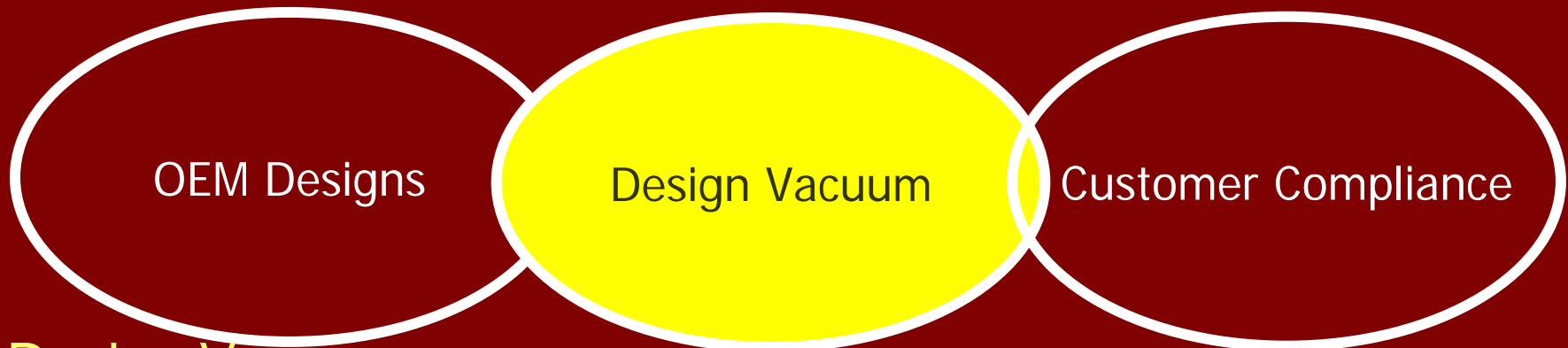
# Recommendations cont'

- Design Improvements
  - Aim for longer rim and rim component fatigue life - reduced exposure to fatigued rims & components.
  - Eliminate 'sprung' lockring systems that rely on the 'shape' of the lockring to provide the required integrity of the final assembly - '2 piece lockring' systems
  - Reduce or eliminate removal of wheels/rims during tyre change - successfully resolved by 'double gutter rim' concepts - more/all mine sites need to take up this solution.
  - Design modifications - positive removal of valve to achieve deflation of the assembly, and its dual, before a wheel can be physically removed.



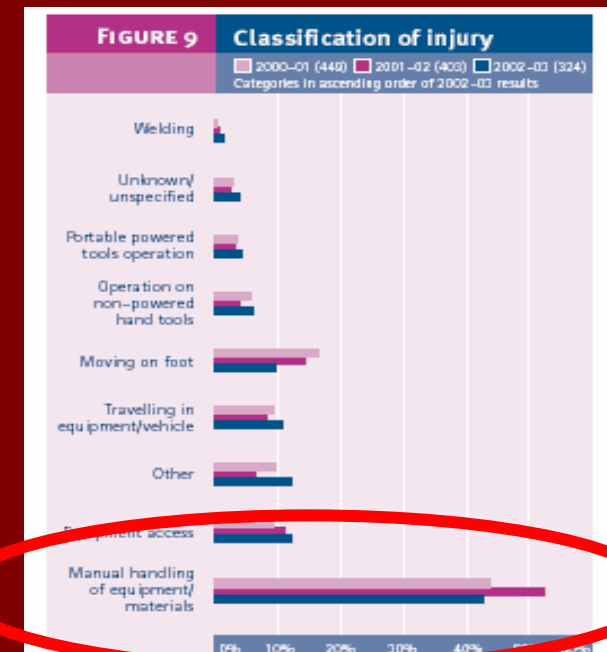
# Example – Rim Design & Rim Integrity – Sprung Lockrings

Graphic form EMESRT – Earthmoving Equipment Safety Round Table - newsletter



## Design Vacuum

- ‘Dated’ design solutions – look at automotive industry – single piece rim
- Intrinsic Safety
- Maintain-ability
  - Manual handling
  - Whole body vibration - tooling
  - Tyre change times - productivity



From Qld Mines & Quarries Safety Performance Report 2002/03 Classification of Injuries



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# Recommendations cont'

- Tyre and rim manufacturers, and rim users consider and implement a consistent Standard to identify rims and rim components, to minimise mismatch of components.
  - Capture in an International Standard ? – systemise it
- Assess effects of 'whole body vibration' on tyre servicemen, as a separate study group.



# Recommendations

- Fatigue damage of structural components on tyre handlers and manipulators – manage through non destructive fatigue testing regime & capture testing programs in a Guideline or Australian/International Standard.
- Carry out a comprehensive review of all available tyre handler/manipulator designs aiming to improve handling and safety capabilities.
- Introduce an annual review process of tyre and rim related incidents and accidents, with feedback to the industry - Klinge/MISHC joint project



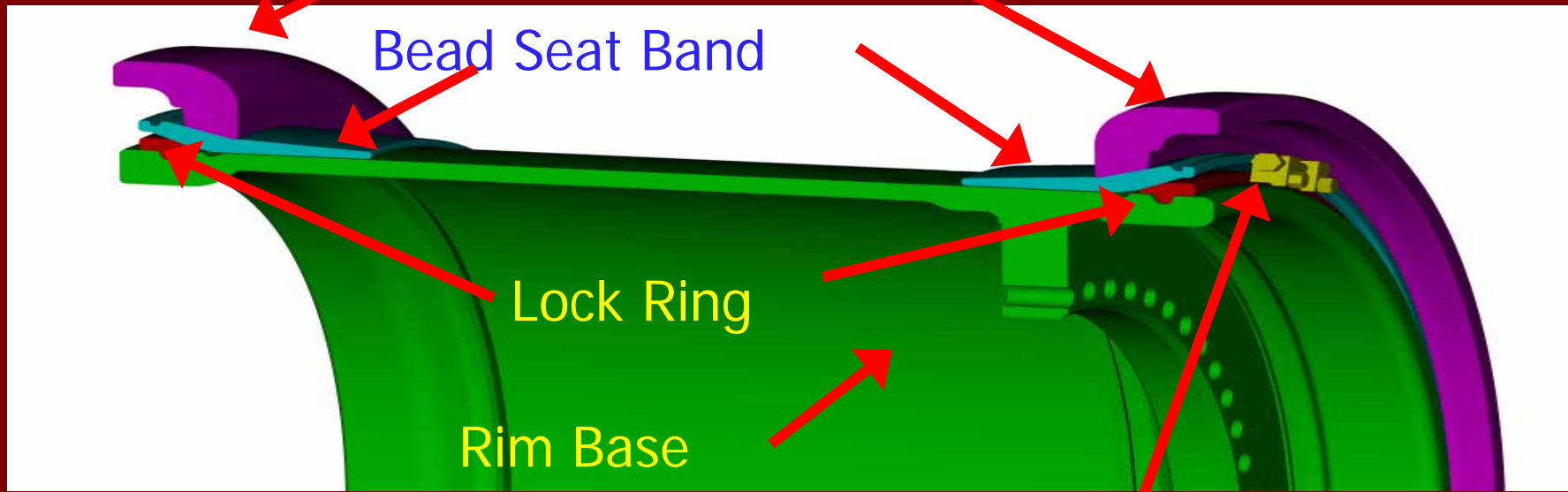
# Recommendations

- The ongoing data population and analysis ought to remain consistent with this study so that year to year performance changes and priorities can be established.
- As a project initiative, encourage industry to report all tyre and rim related incidents and accidents, near misses and mishaps as well as operational damage, e.g. 'hot tyres' (as compared to tyre fires) incl actions taken, without exception for inclusion in this database.

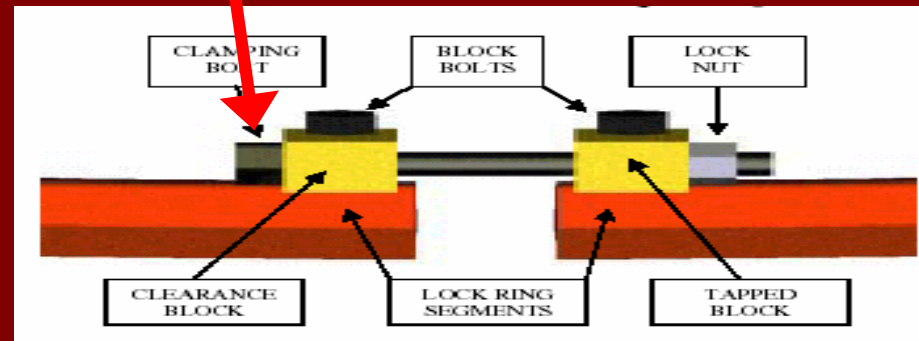


# Intrinsically Safer Rims Double Gutter Rim Assembly

## Side Ring / Flange



## Lock Ring Clamping Bolt



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## Example: intrinsically safer rim designs

- 47% reduction in tyre change duration
- Reduced use of pneumatic tools as rims remains on vehicle
- Only 4 lockring retaining bolts need to be undone to remove tyre



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# Industry Recognition: BMA Goonyella Riverside



Alan Heading (BMA Goonyella Riverside), David Trenberth (Klinge – GYR) & Tilman Rasche (Klinge – Spring Hill)



David Trenberth (Klinge – GYR) accepting the Award in Sydney



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# Where to from here?

- Tyre & rim service work potentially very hazardous.
- Significant hazards
- Intrinsically safer designs to fill design vacuum.
- Improve awareness from operator level to senior management through ...
- Structured tyre awareness sessions
- Accredited tyre servicemen training
- Put in place proactive tyre management





Thanks to ACARP & Industry for their support on  
this project

Thank You, have a Safe Journey Home

The Klinge Team



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