17th MECHANICAL ENGINEERING SAFETY SEMINAR

Prepared and presented by W J Koppe BSc Mech. Eng.
Inspector of Mechanical Engineering NSW Department of Primary Industries on 16 August 2007

Plant and Equipment Mechanical Presentation

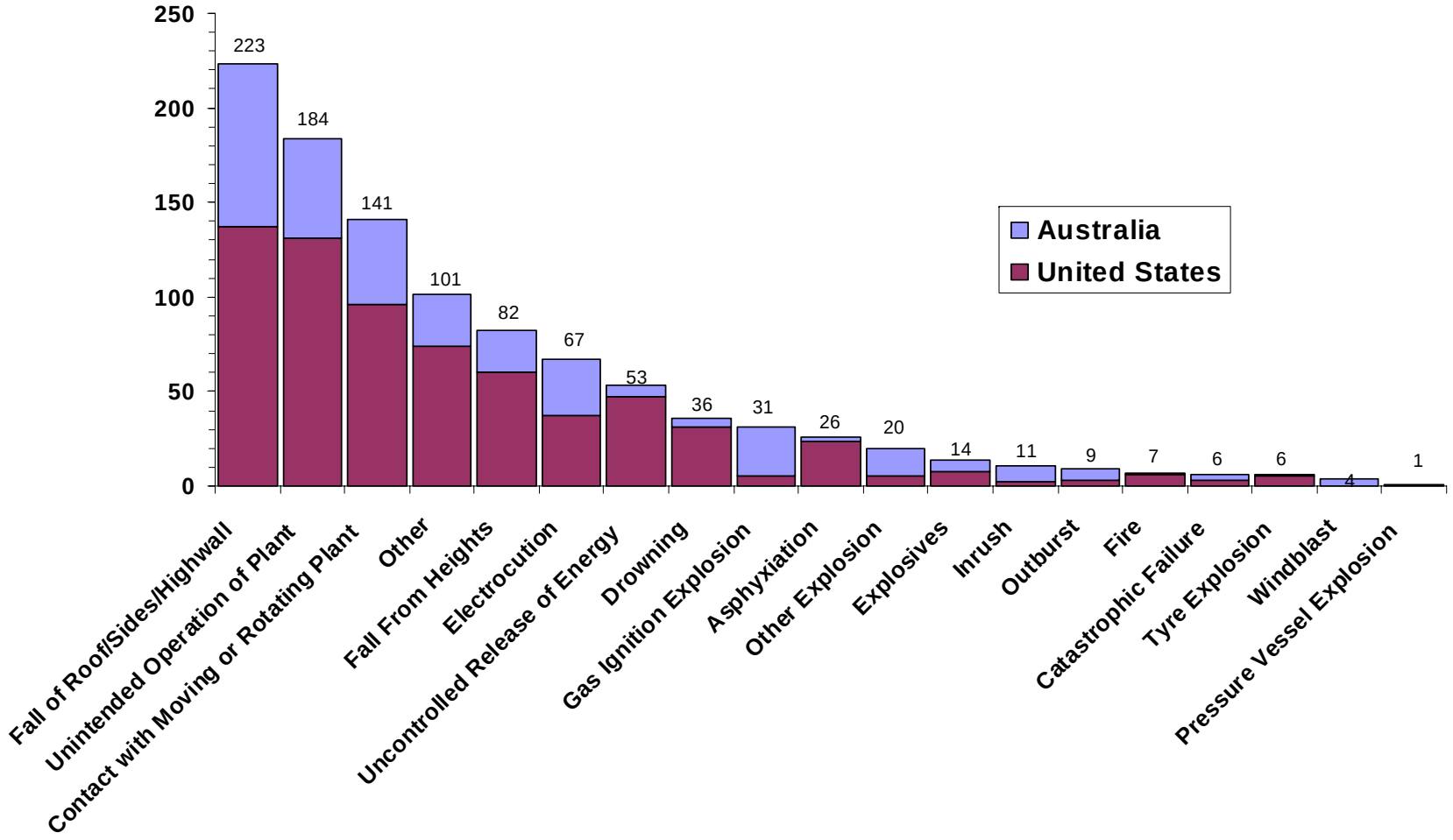
- **Trucks**
- **Loaders**
- **Conveyors**
- **Drilling and Bolting Equipment**
- **Cranes/Forklifts/Lifting**
- **Crushers**
- **Shuttle Cars**
- **Continuous Miners**
- **High Pressure Hydraulics**

Introduction

In order to assist to identify where the efforts of the mechanical section of the Inspectorate should be concentrated, a fatality review was carried out by a final year university student Russell Noon. The result was the identification of 1022 fatalities in Australia and the USA, each of which was allocated to various categories.

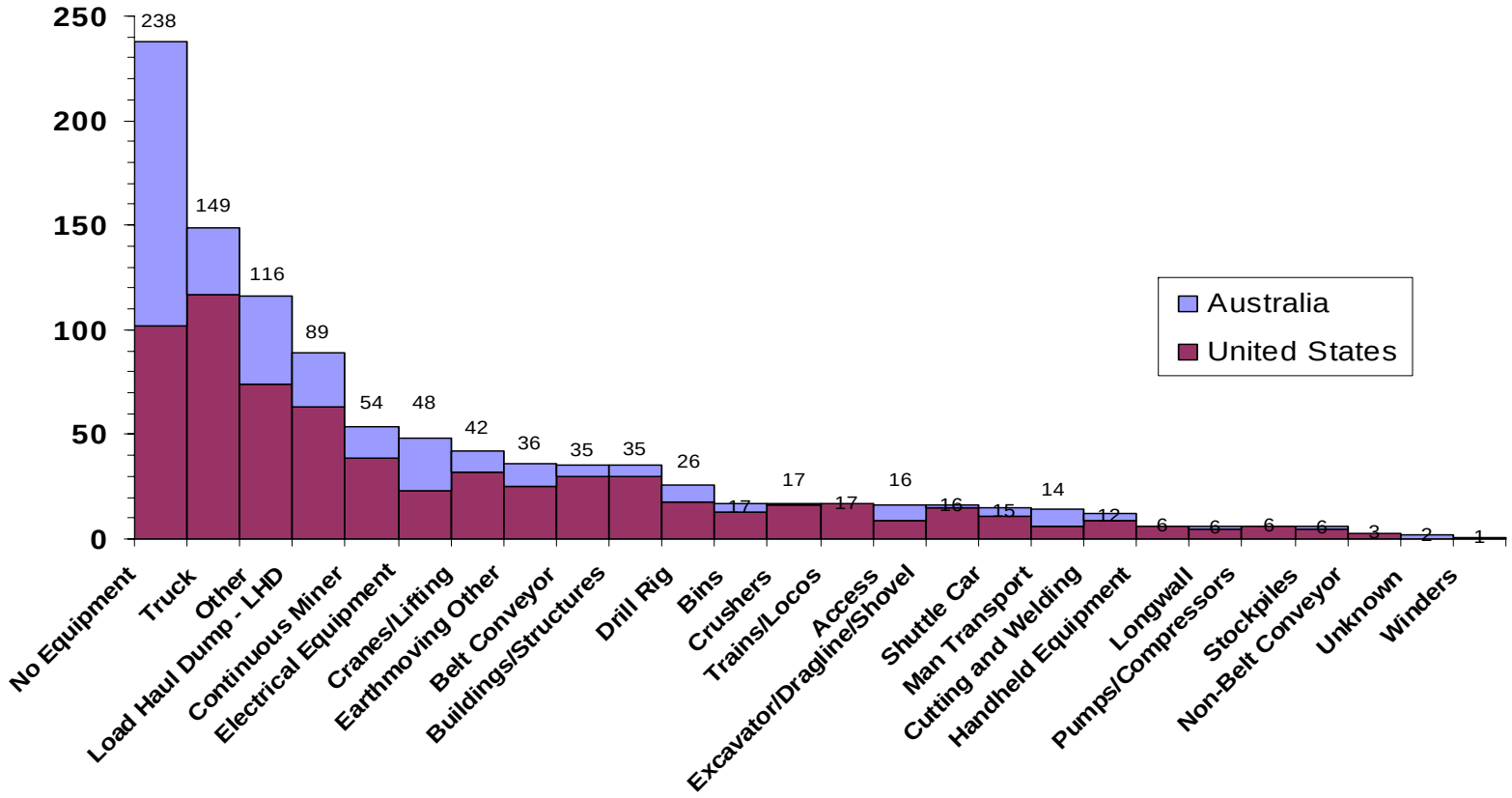
This data will be placed on the Department of Primary Industries web site during September 2007 and it is anticipated the data will be updated during February 2008 with the latest fatalities.

Agent of Fatality – Total 1022



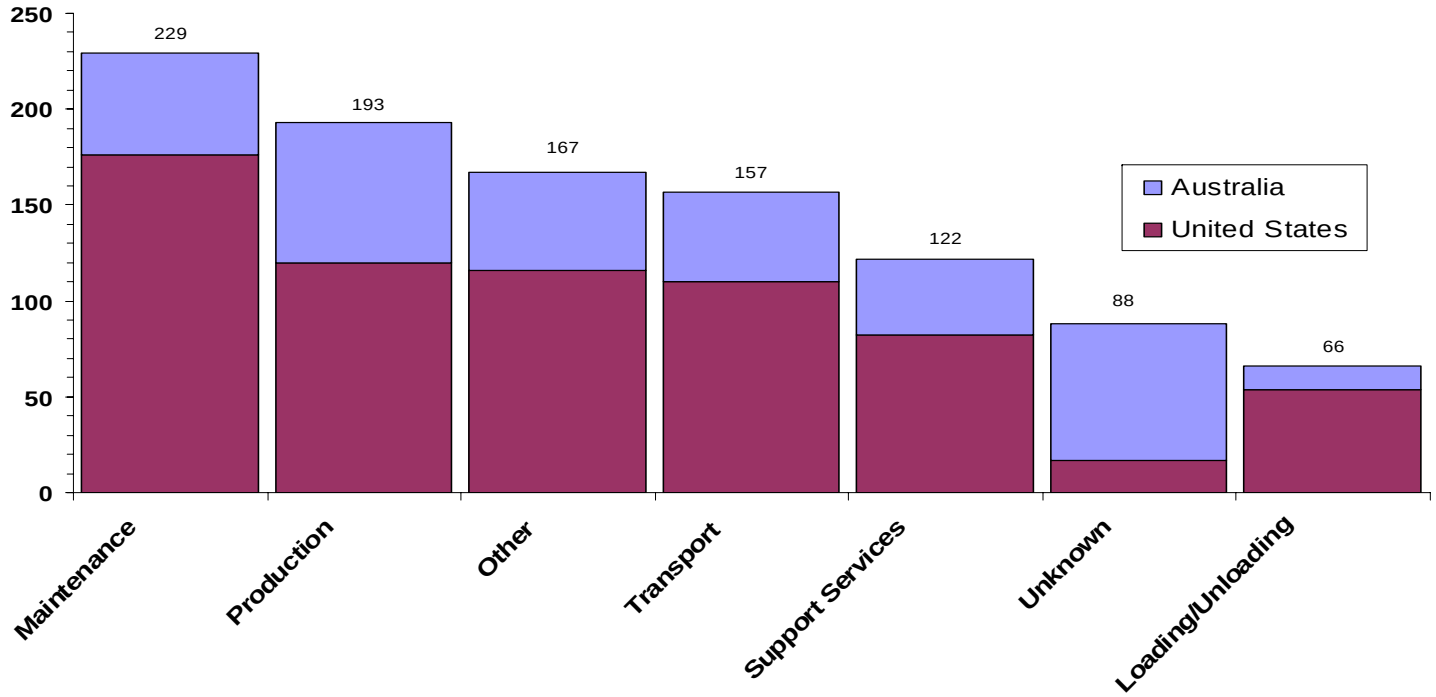
It was identified that core risk or high risk activities were involved in less than half the fatalities and that over half the fatalities were equipment related.

Equipment Involved



The activities at the time of the fatality were also analysed.

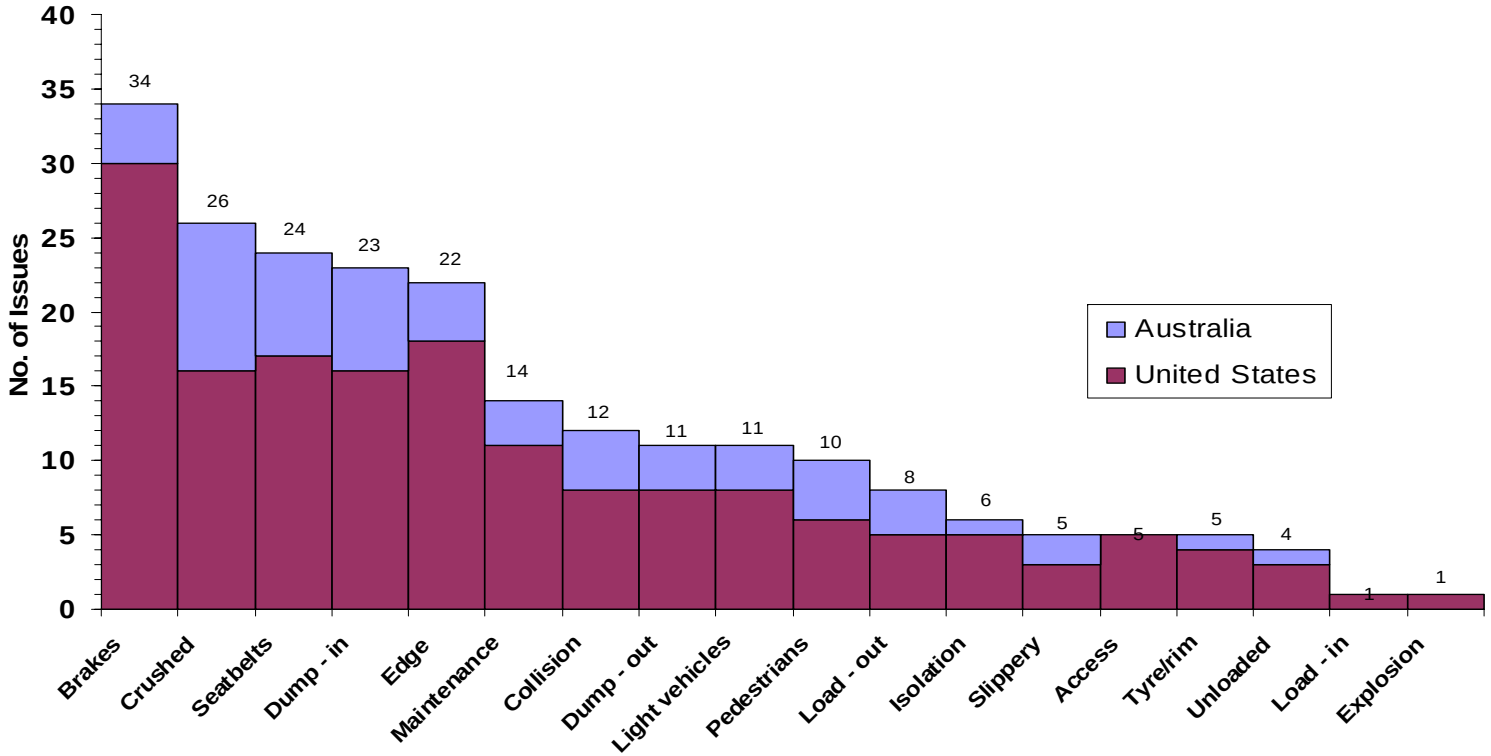
Activities at Time of Incident



The issues involved with specific areas of specific equipment were also reviewed for the following equipment

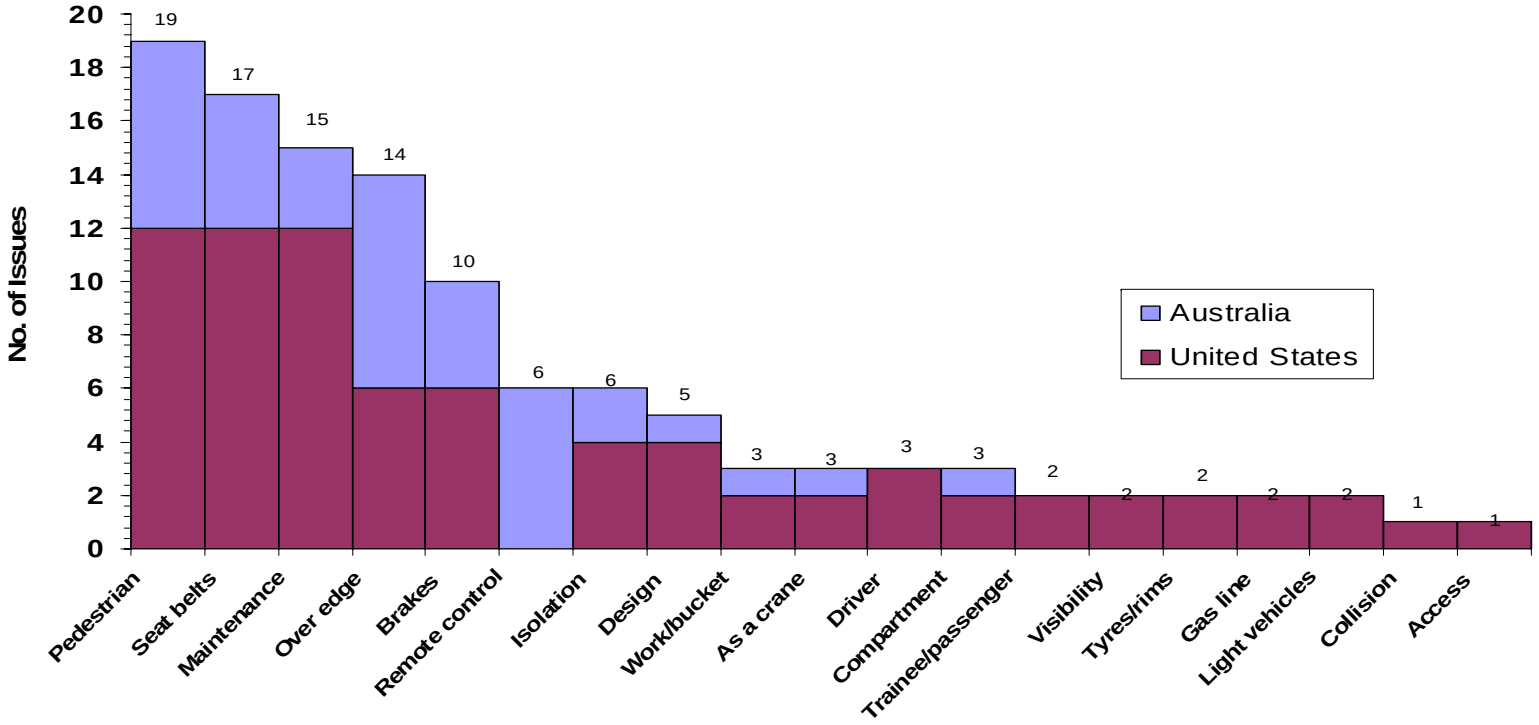
Trucks /Light Vehicles

Trucks/Light Vehicles – 147 Fatalities
222 Issues

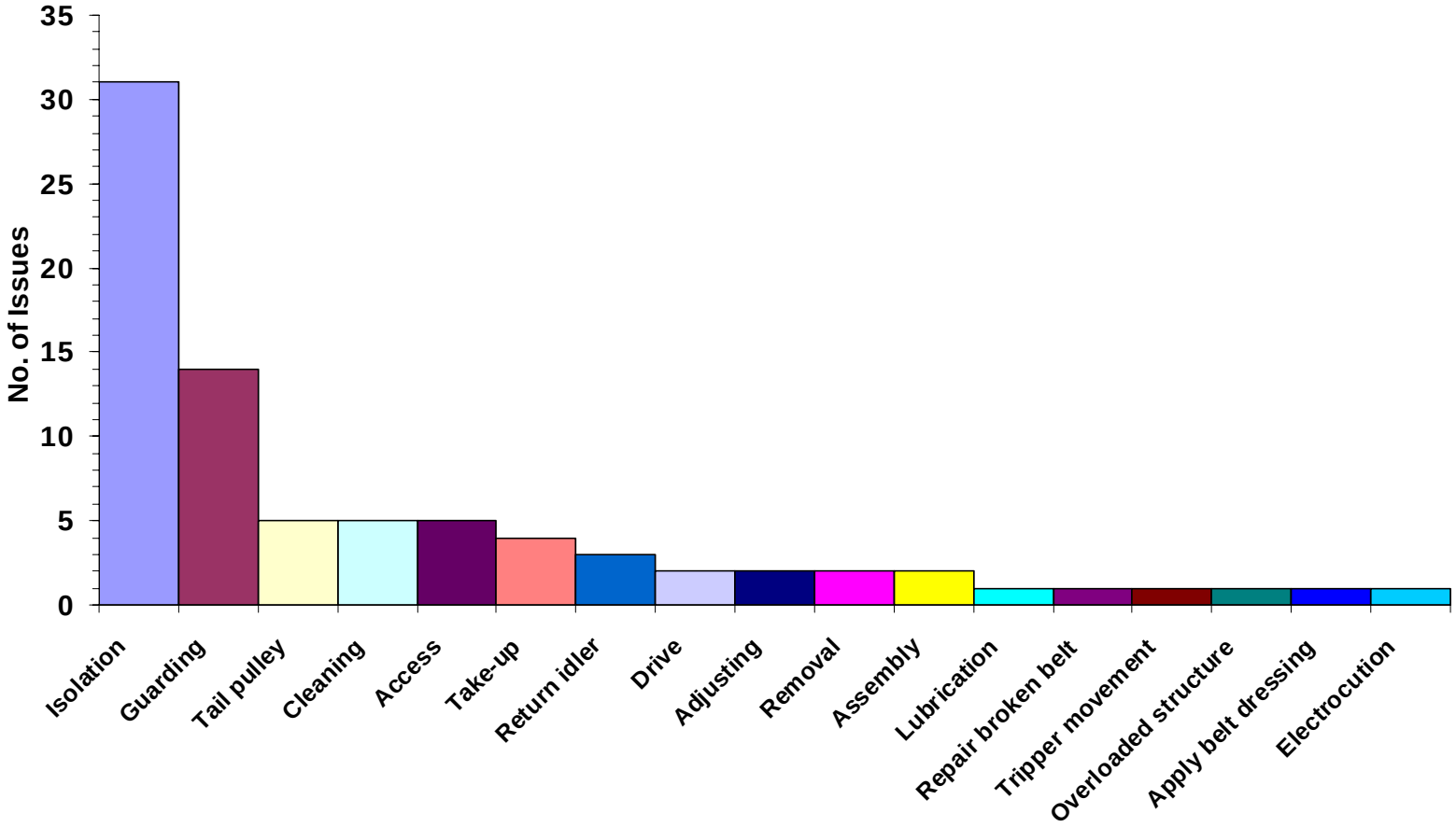


Load Haul Dump Vehicles

Load Haul Dump Vehicles – 90 Fatalities
116 Issues



Conveyors – 37 Fatalities
81 Issues



- The foregoing first was presented to Mine Mechanical Engineers at the Mechanical Safety Seminar during 2004.
- Since this data was collected there have been numerous further fatalities involving the same equipment, in particular:
- Conveyor fire – USA
- Shuttle car fatality – QLD
- Tyre changing - NSW
  - QLD
- High pressure LW hydraulics - NSW
  - USA
- Winder – NSW
- LHD remote control – NSW

DRILLING AND BOLTING EQUIPMENT

- **Drill Rigs**
- The Department of Primary Industries has for some time been attempting to promote improvements in safety relating to drill rigs which were involved in 26 fatalities in the Australia/USA database. Further analysis of the fatalities involving roof/rib falls has identified 52 fatalities involving bolting and drilling equipment.

FATALITIES – Drilling/Bolting

NSW - Queensland - Western Australia - Tasmania - New Zealand - USA

Open Cut	15
Underground	35
Unknown	2
TOTAL	52

- The categories of these fatalities are shown on Slide 8 (below)

CATEGORIES

ROOF FALL	**22**
RIB FALL	**4**
HIGHWALL FAILURE	2
GROUND FAILURE	2
ROLL OVER	2
RELOCATING	3
STOPING	1
DROWN	1
MAINTENANCE	**2**
MACHINE DESIGN	**16**

- Machine design includes entanglement and accidental operation.

MACHINE DESIGN 16

ENTANGLEMENT	7
ACCIDENTAL OPERATION	3

- A presentation covering “Strata Drill Rigs Machine Mounted – Accident Prevention – Progress” was made to District Mechanical Engineer in Charge Meetings during late 2004.
- Presentations on improvements to drill rigs have been made at two Mechanical Mine Safety Seminars by a representative from ARO/Hydromatic.
- A guideline for drill rigs MDG35 is very close to publication. It is already in use by many in the mining industry.
- This guideline includes an analysis of Coal Mine Services Insurance Data to further identify specific issues and how they are covered by the guideline.
- **NOTE:** The current draft of the guideline has not included the many incidents involving hydraulic hose failures. Hopefully this will be added before publication.

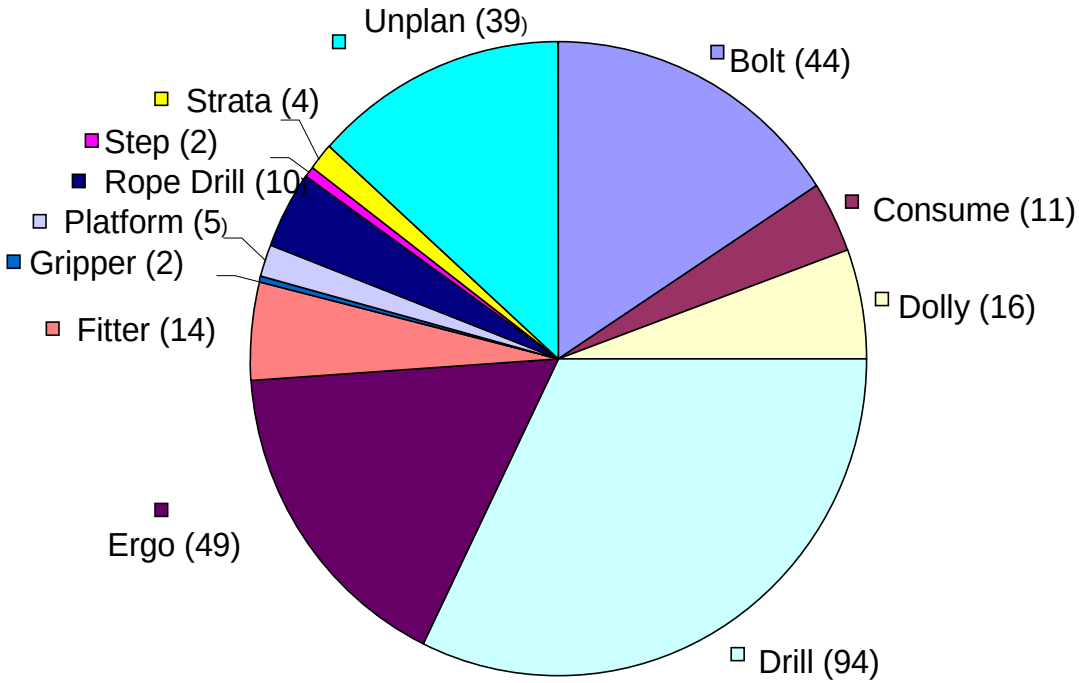
APPENDIX C – INCIDENT STATISTICS

- **Accident Report Data**
- Analysis of accidents from Roof and Rib Bolting Practices in NSW coal Mines
- Date of Issue: June 2005
- The following information is an analysis of data supplied by NSW Coal Services on the accidents involving mobile bolting equipment used in NSW coal mines. The study covers the years from 1999 to 2004 and highlights:
- 292 accidents associated with operating and maintaining roof bolting equipment
- 55 accidents occurred during some part of the rib bolting process

- The graph below gives a broad breakdown of the root causes of roof bolting injuries.

Roof Bolting Root Causes

Insurance Data Incidents



EXCLUDES HOSE FAILURE INCIDENTS WHICH ARE NUMEROUS

- I consider the majority of drilling/bolting equipment currently does not adequately comply with:
- Priority (hierarchy) of risk control
- Guarding requirements (AS4024)
- Isolation requirements
- a documented safe system of work

Non Compliances

1. Priority of Risk Control
2. Guarding
3. Isolation
4. Safe Work Procedure

Issues

Minimise

- Man/machine interface
- Inadvertent operation
- Manual mechanical drill guides
- Potential to mix up controls
- Potential for rib/roof injuries
- Ergonomic issues
- Hydraulic hose failures

- Risk Barriers
- Two handed control
- Slow speed for on handed control
- Individual shaped control knobs
- Pre-start warning
- User friendly hydraulic isolation/emergency valves
- Operator protection – rib
  – roof
- MDG 35 and 41 Compliant

- **NOTE:** Although the MDG35 working group considered adopting the USA Operator Protection Requirements, it was determined that this was too prescriptive in some areas, hence alternative means of achieving adequate operator protection has been included. For example modification to conventional timber jacks so they are capable of better protecting the operator and providing some roof support when drilling is being carried out.

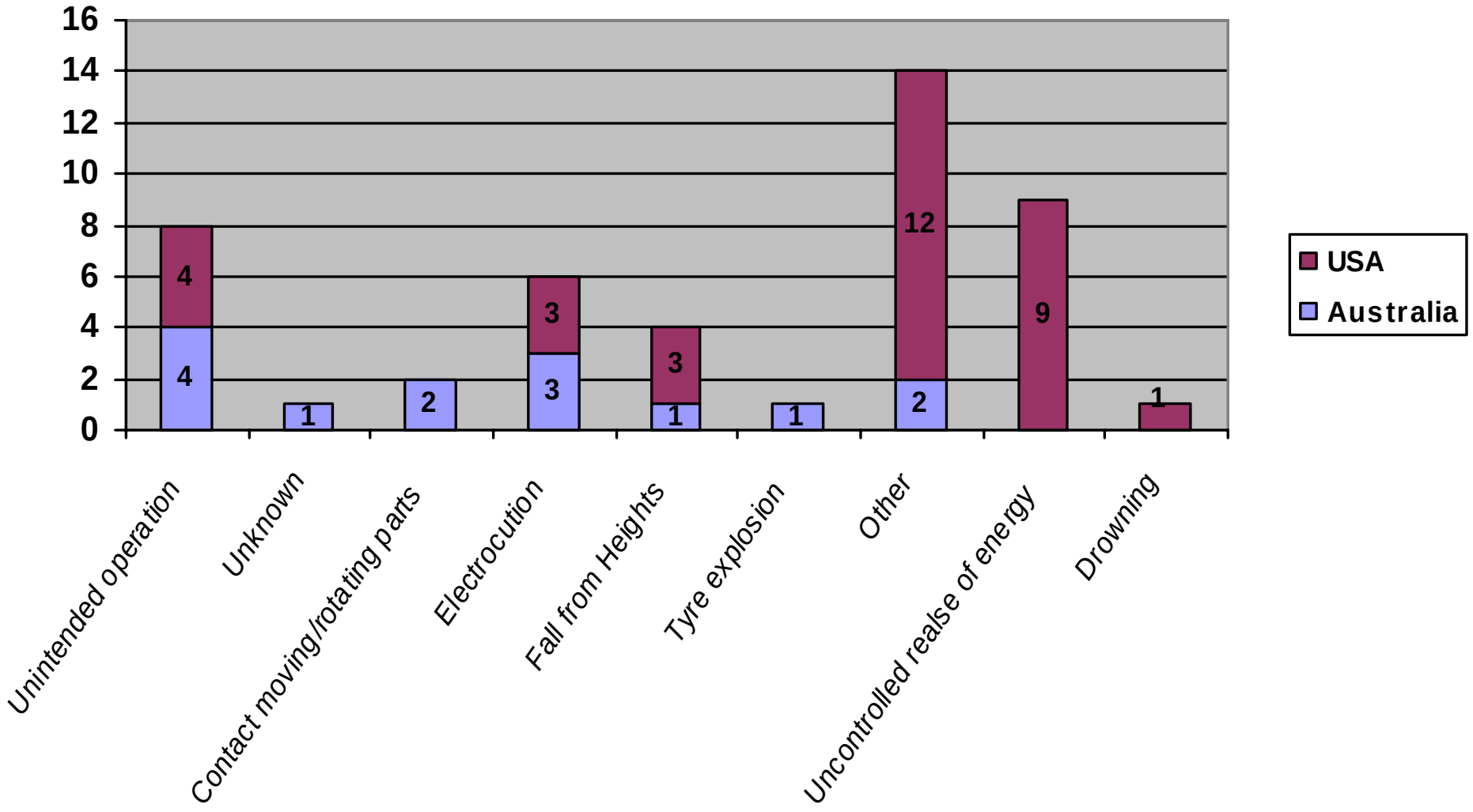
Fatalities Involving Surface Drilling Equipment

- A number of fatalities have occurred involving large surface drilling equipment. At least four coroners' inquests are available and the associated recommendations should be adhered to.

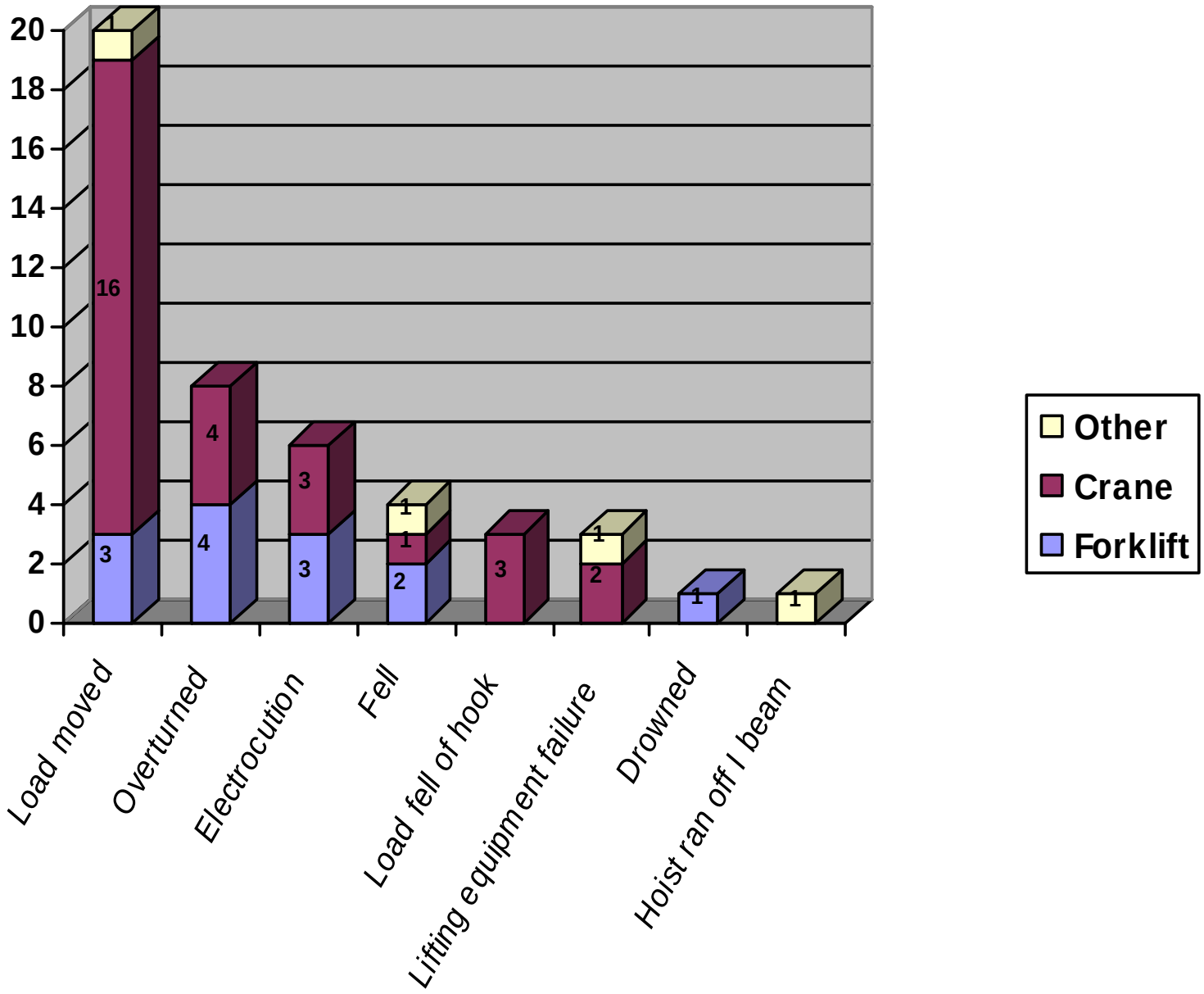
What Equipment Requires Improvements

- Rib bolters
- Roof bolters
- CH4 drainage drilling equipment
- Underground exploration drilling equipment
- Surface exploration/blasting drilling equipment

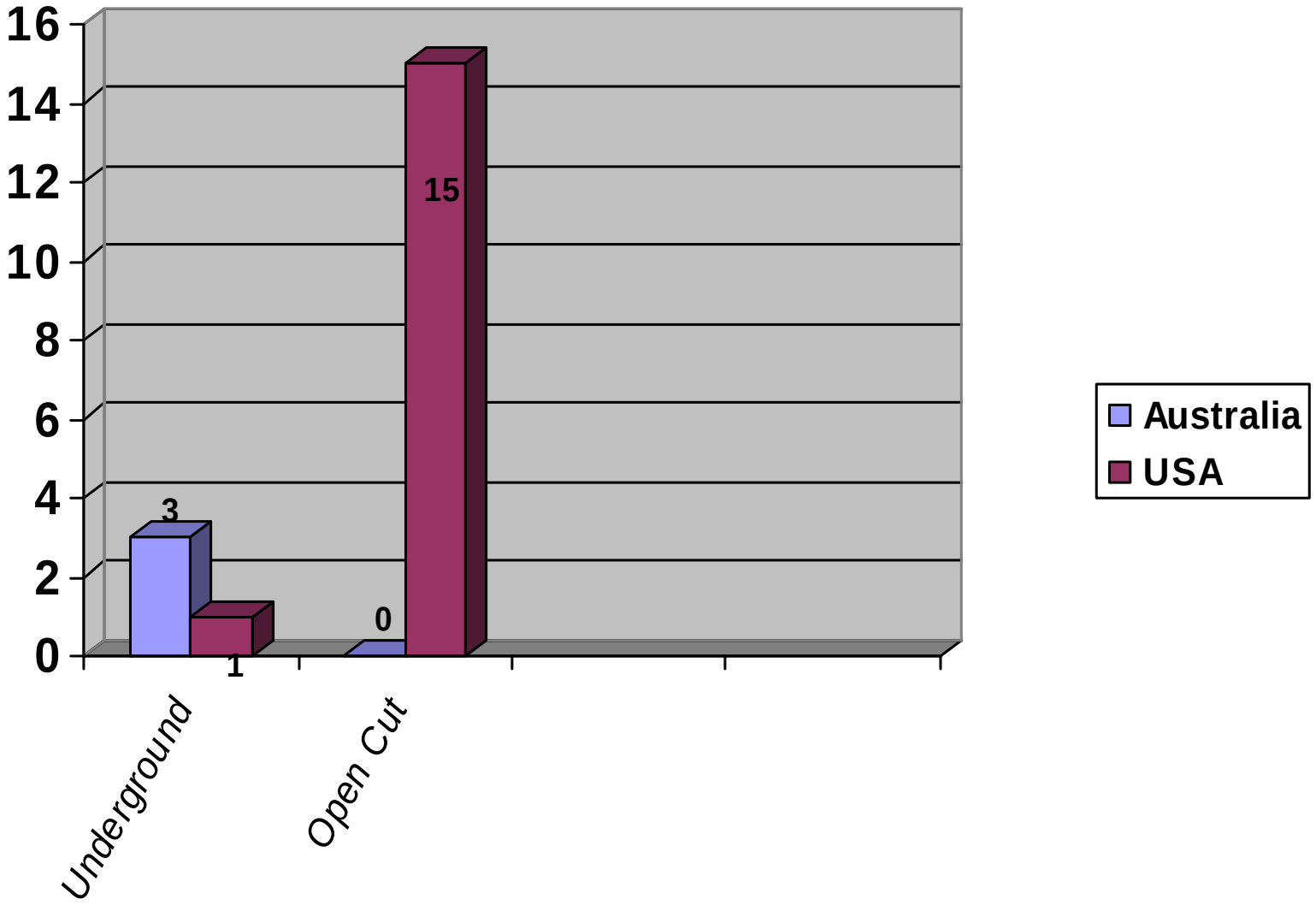
CRANES/FORKLIFTS/LIFTING



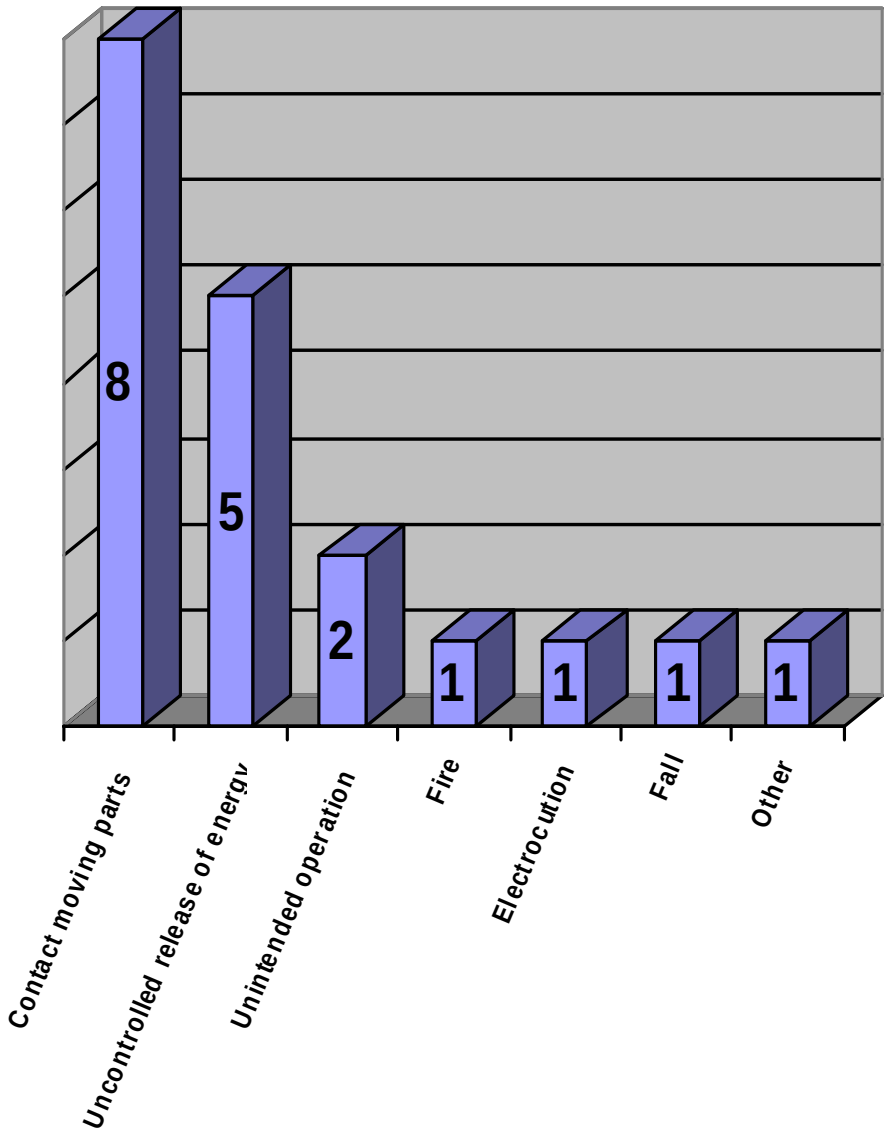
CRANES/FORKLIFTS/LIFTING



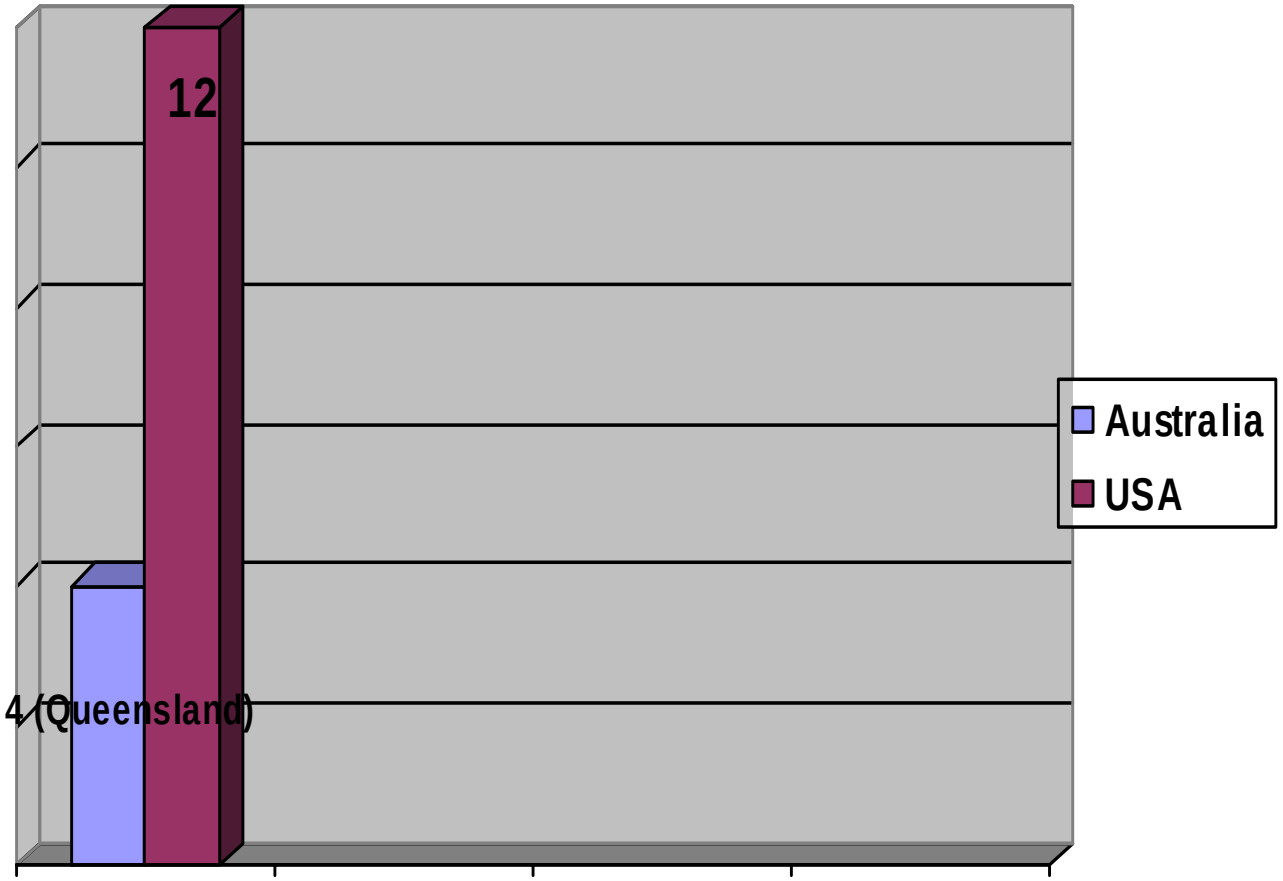
CRUSHERS



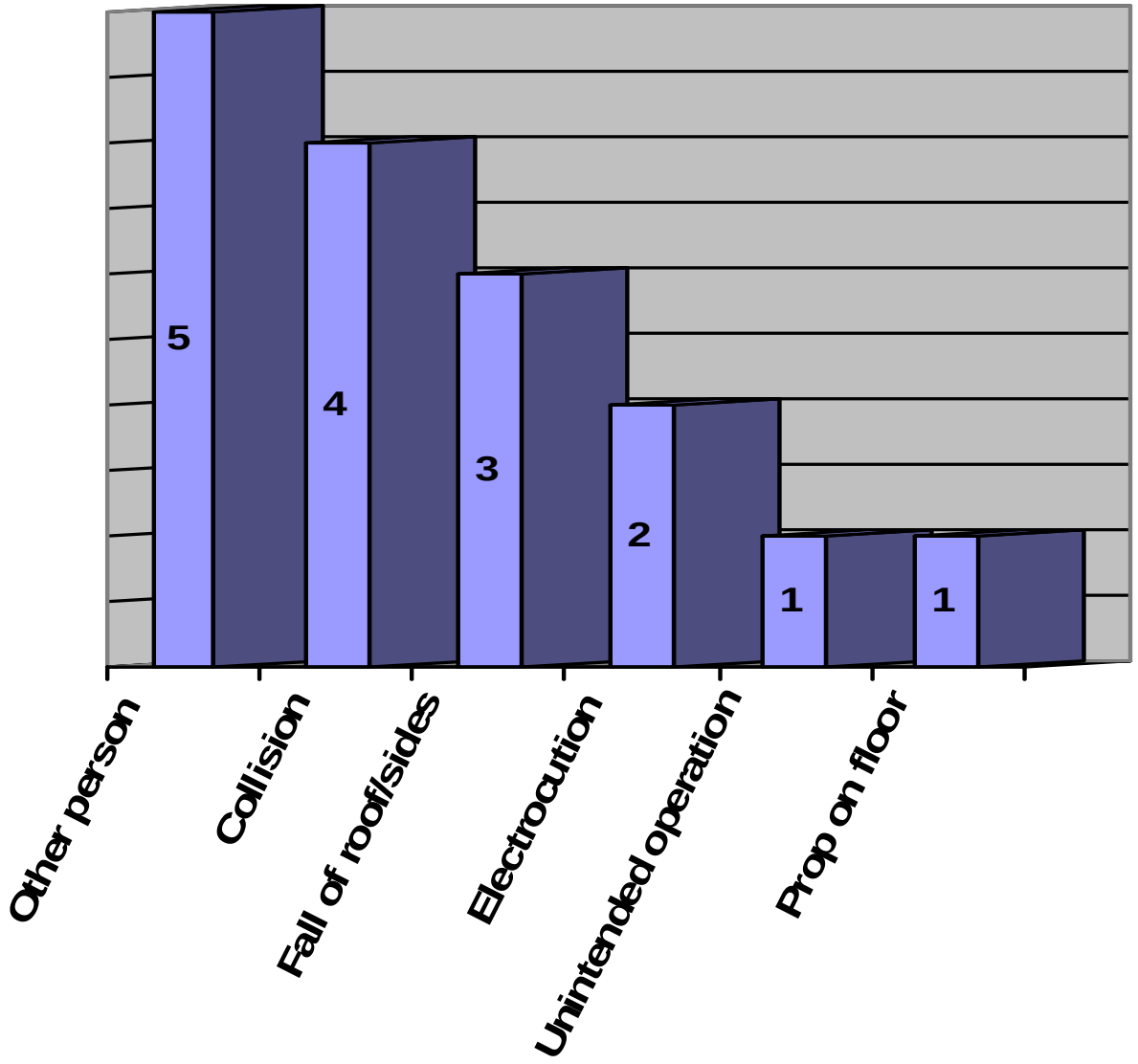
CRUSHERS


8
5
2
1
1
1
1
Contact moving parts
Uncontrolled release of energy
Unintended operation
Fire
Electrocution
Fall
Other

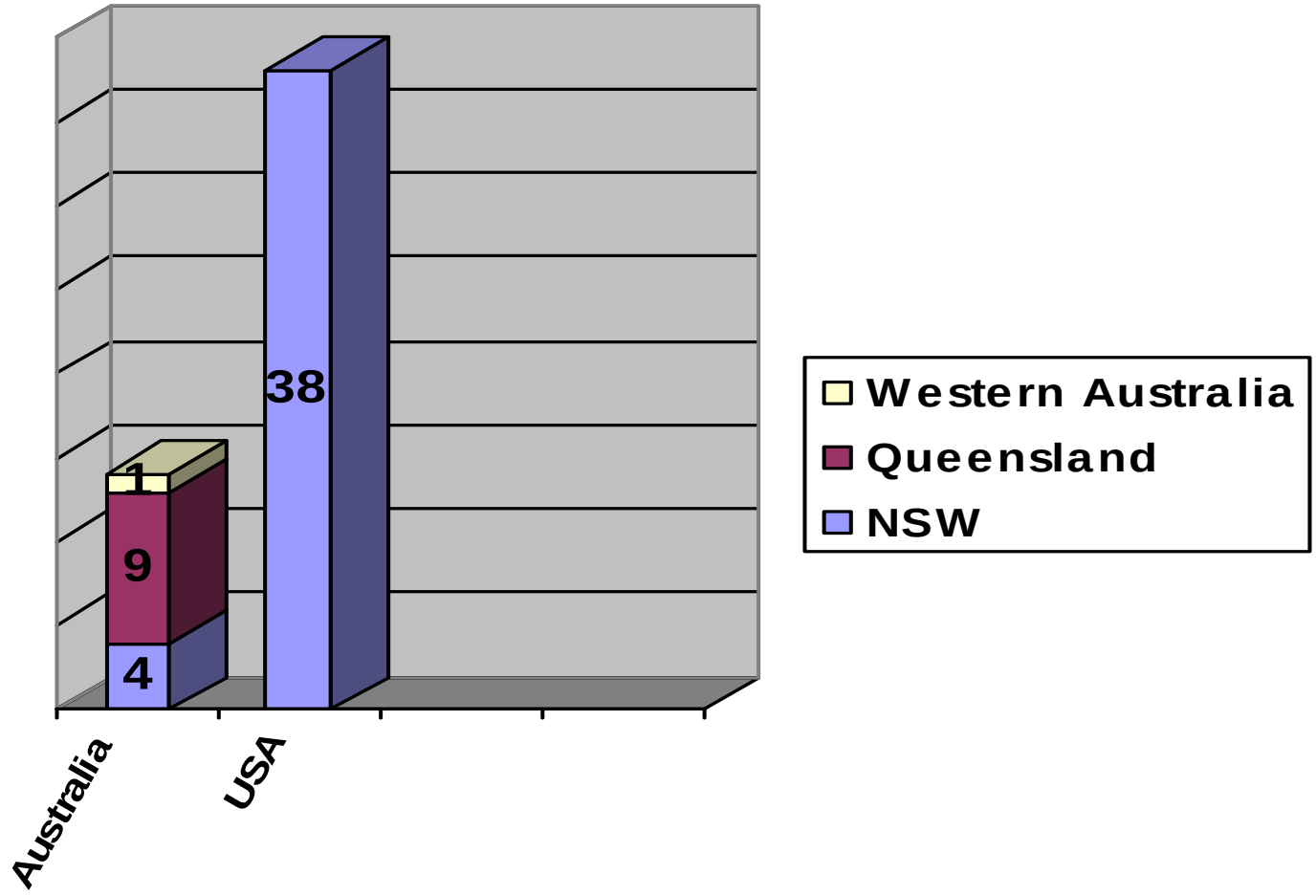
SHUTTLE CARS



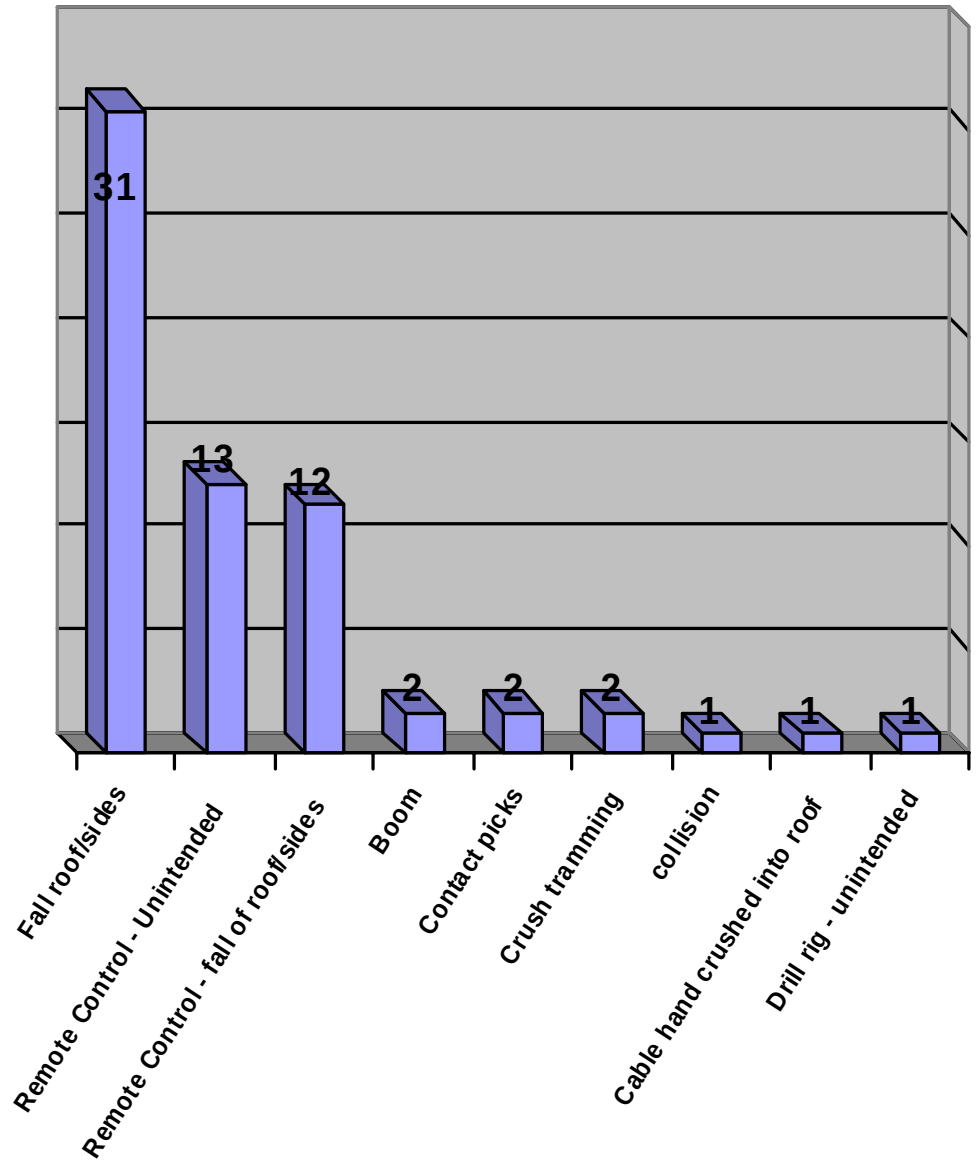
SHUTTLE CARS



CONTINUOUS MINER



CONTINUOUS MINERS – ISSUES

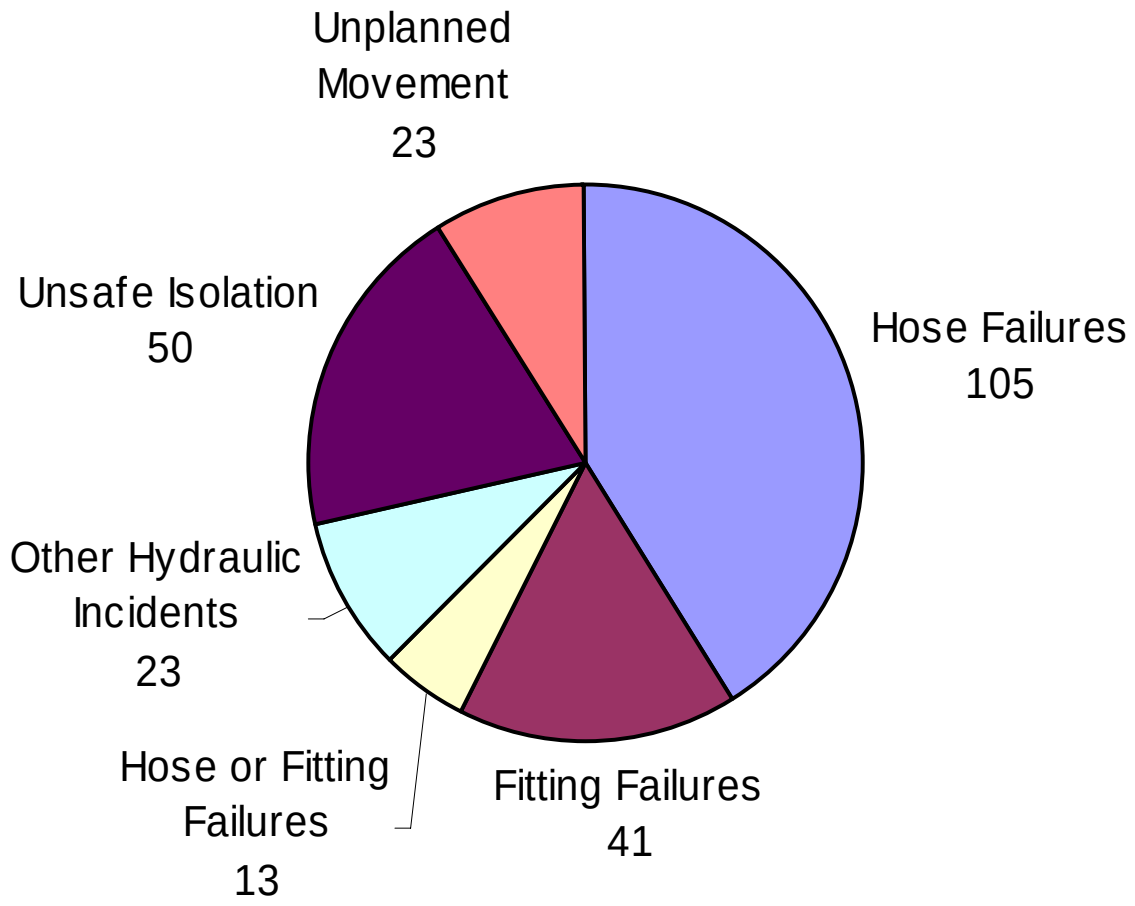


HIGH PRESSURE HYDRAULICS

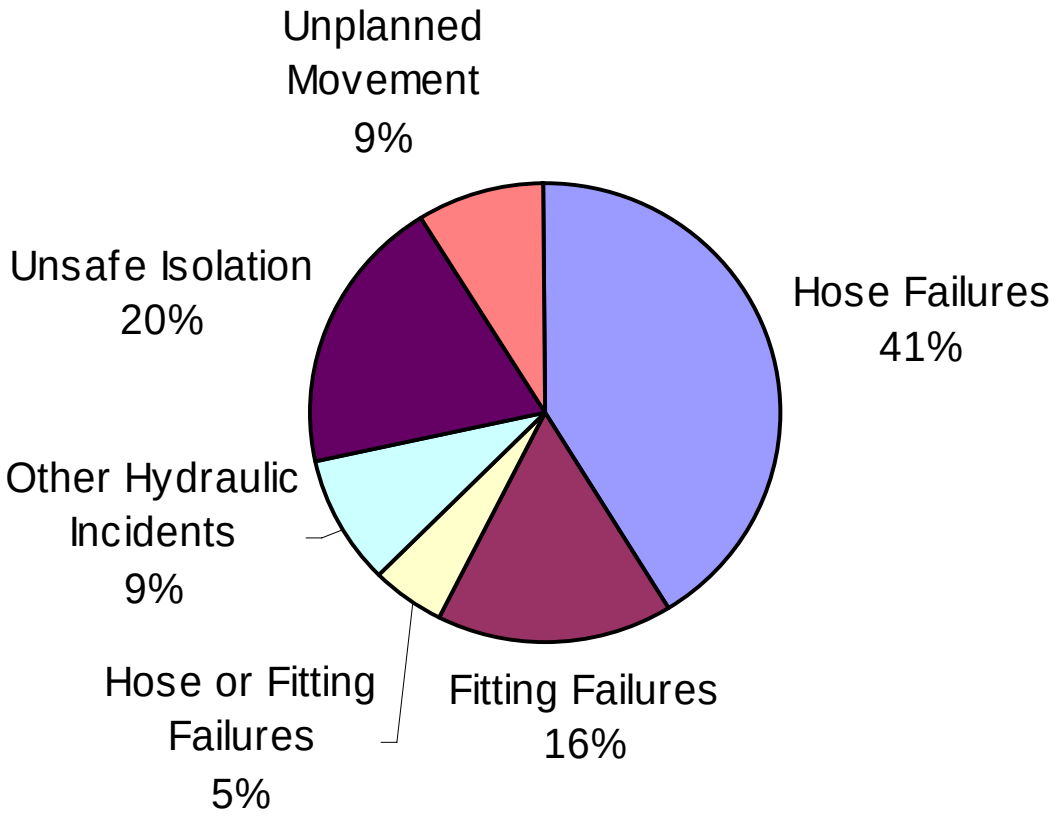
FATALITIES

- Gretley – Hydraulic intensification of chock leg circuit – oil injection
- South Coast – Failed accumulator fitting on accumulator start circuit of diesel engine – oil injection
- Angus Place – Disconnected staple fitting on LW hydraulic pump station

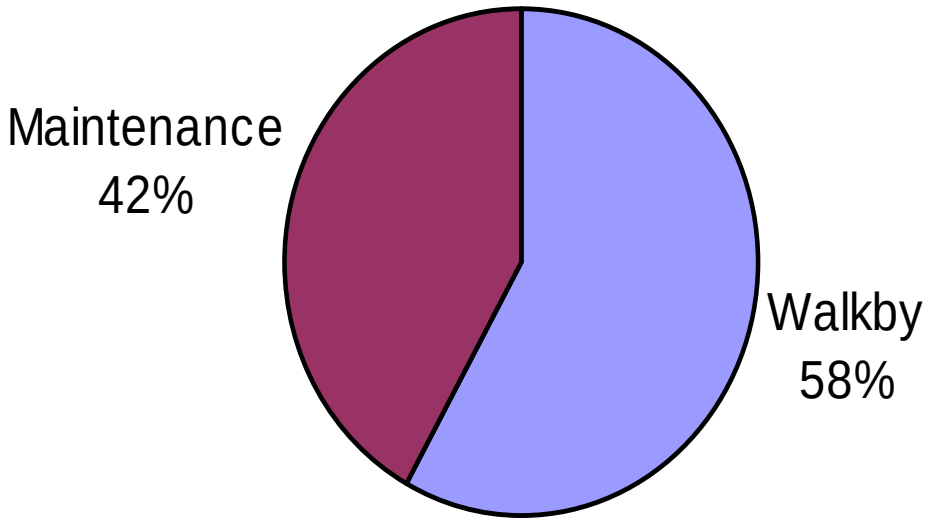
255 Longwall Hydraulic Incidents over 8 years from C.M.S. Insurance



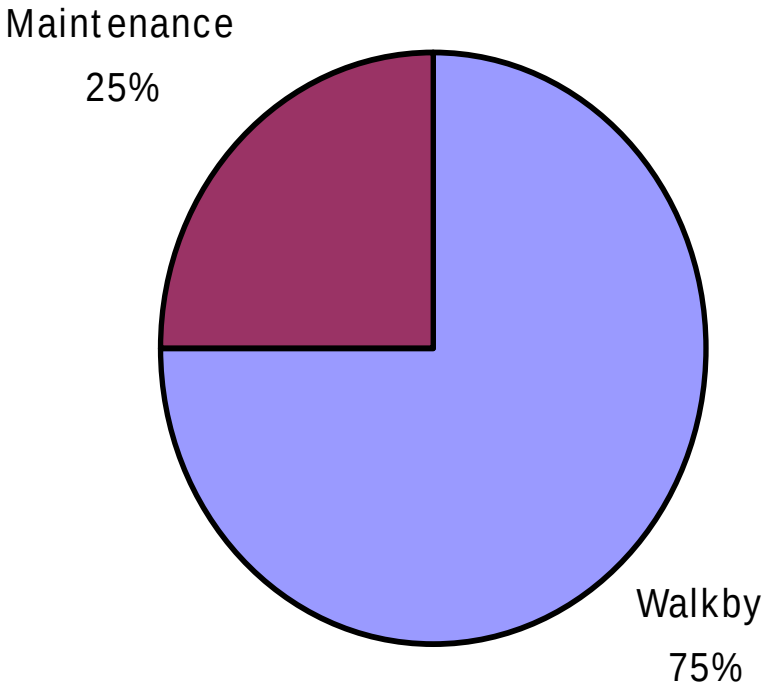
Longwall Hydraulic Incidents



255 Incidents



Hose or Fitting Failure 159 Incidents



Conclusions

Longwalls are not a safe workplace to walkby

BECAUSE

- Hose and fittings management
- Unplanned movement
- Miscellaneous

In addition

Working on high pressure hydraulics is not safe

BECAUSE

- Unsafe isolation

Standards & Guidelines

- MDG 40
- MDG 41 Final Draft completed
- AS 2671 ≅ ISO 4413
- AS4002.2 ≅ ISO 4021
- AS 4024
- EN 982

Current DPI / Industry Project

Extend MDG41 with a

- Specific Longwall section to improve hoses and fitting management
- Isolation practice/equipment
- Unplanned movement potential
- Pump Stations
- Monorails
- Staple hydraulic fitting standards
- Competency

Recommendations

1. Use the fatality data base as input for all risk assessments.
2. Conduct an audit/review of our equipment to identify the gap analysis
3. Consider the issues involved with equipment and ensure these issues are adequately managed
4. Risk review and prioritise
5. Allocate capital
6. Extend the process to equipment not yet analysed.