Comparative Safety Statistics for Mobile Equipment Operators at Hail Creek Mine

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1. Abstract:

Hail Creek Mine commenced operations in 2003. At that time a strategic decision was taken to employ a higher proportion of female mobile equipment operators than was the current norm in the Bowen Basin coal mines.

This decision was taken in the belief that a higher proportion of female operators in the workforce would create the opportunity for gender balance, moderating behaviour and therefore contributing to a safer work environment. The decision would also emphasise meeting commitments in terms of equal opportunity and local community employment expectations.

The pool of female mobile equipment operators available to the mining industry is relatively small when compared to male operators. This resulted in a high proportion of female candidates from outside the industry with no operating or mining background being employed. Hence the mine has endured demanding levels of mobile equipment operator training during its short life.

Three years on there is now an opportunity to review and perform analysis on the incident data compiled in the mine to date, ascertaining the effectiveness of the implementation of this strategy. This paper provides the analysis and draws conclusions on how effecting the strategy might be enhanced.

2. Background

2.1 General

Hail Creek Mine is a Rio Tinto Coal Australia operation located 100km due east of Mackay in Queensland. The mine is an opencut coal dragline operation and produces coking coal for the export market.

Construction of the mine commenced in late 2001 and was completed in mid 2003. This included a coal wash plant, rail link, a mobile plant fleet and site infrastructure. The initial mining operations commenced using trucks and excavators in March 2003 and the first coal was mined in June that year. The first coal was railed from the mine to Dalymple Bay in July 2003 and the first shipment left in August that year. The dragline was commissioned in September 2004 completing the initial Hail Creek project work.

In the first two full years of operation the mine produced in 5.1mtonne, in year 1, and 5.9mtonne, in year 2, of coking coal. In February 2005 the construction of a second wash plant and second dragline was approved providing capacity for the mine to produce 8mtpa. This expansion of operations is to be completed in mid 2006.

Throughout the mine life the workforce has increased to meet the increase in mine operating capacity. The mobile equipment operator total required in the Mining MRU is now at 151.

The build up to this total is shown in Figure 2.1.

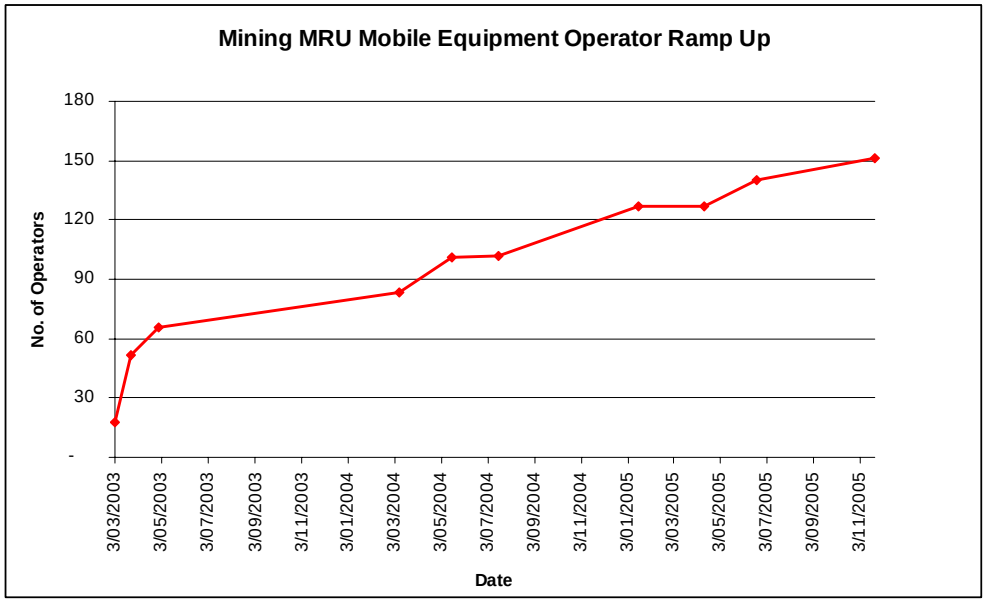


Figure 2.1

2.2 Recruitment for Hail Creek – Strategy to Increase Female Operators

Hail Creek began to compile the operating workforce at a time when the labour demand began to pick up in the Bowen Basin coalmines. The recruiting strategy was determined in 2002 based on the concept that the mine would develop and sustain a culture able to continually achieve outstanding safety performance. This meant some change from the norm would be necessary and it was reasoned that change would be in the form of a higher percentage of female mobile equipment operators.

The employment of higher proportions of females was explored. It demonstrates some clear advantages in terms of having balance in the workforce and is socially responsible in terms of meeting equal opportunity objectives. Consideration of females doubles the pool from which to access and pick new employees, countering the “skills shortage”. Anecdotal experience from people who had worked in regions of Australia where female operators are more common appeared supportive. In addition recent OHS and gender harassment legislation developments have made the work environment less male oriented and more female friendly.

The pursuit of “zero injuries” and “zero harm” work environments in coal mines has lead to the elimination of large amounts of causal factors for soft tissue and sprain/strain type injuries. This in turn reduces the requirement for physical strength as a pre-requisite to work in the industry, further reducing any gender specificity that may have previously occurred.

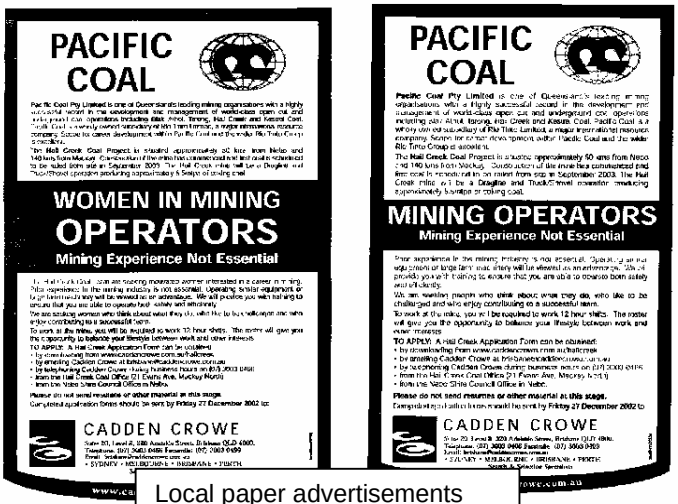
Employment of female operators is not widespread in the coal industry. It was as recent as 1989 when legislation was amended to allow females to be employed underground. While a number of the mining contractors have been active in hiring females, examples of meaningful female operator employment numbers are rare in the older owner mined operations.

This leads to some disadvantages in trying to populate an operating workforce with a higher proportion of females. The pool of experienced female operators is small so females with no experience in mining would have to be employed. In this case the mine would have to concede to higher training commitments. So as not to isolate this group, males with no industry experience also need to be hired, further increasing the training demand. Few role models are available for women operators as there are limited numbers of female OCE's, dragline operators or frontline leaders such as supervisors or superintendents.

In the end, the mine settled on a demographic of skill levels enabling the employment targets to be reached and the initial operations to be conducted safely. Namely, a mix of:

- 33% mining industry experience
- 34% some operating skills but not necessarily mining experience
- 33% neither mine experience or operator skills
- a target of 25% female mobile equipment operators

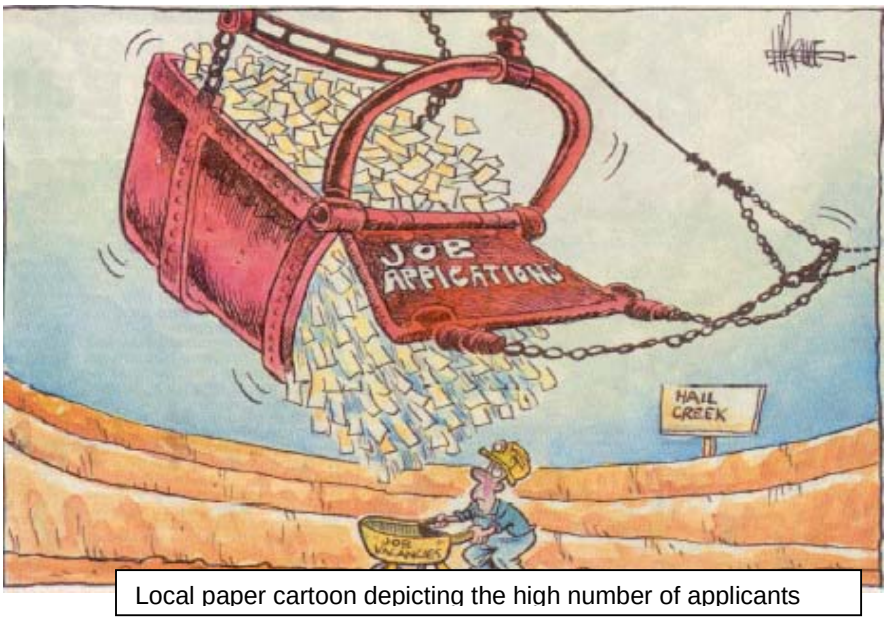
Many females had been keen to enter the mining industry but had found it difficult



Local paper advertisements

so advertisements were run in the local Mackay papers with the specific aim of providing an open door to women, helping achieve this mix.

The result was a positive response, the response to these advertisements was in excess of 5000 applicants, of 1200 were female. Assessment centre style recruiting processes were then engaged to select the employees.



Local paper cartoon depicting the high number of applicants

Throughout the employment ramp up it has been hard to maintain the 25% female proportion and keep crews equipped with the skills needed to sustain the operation. However, in balancing the needs of each intake the female to male ratio has been maintained at 20% up to the last intake in November 2005.

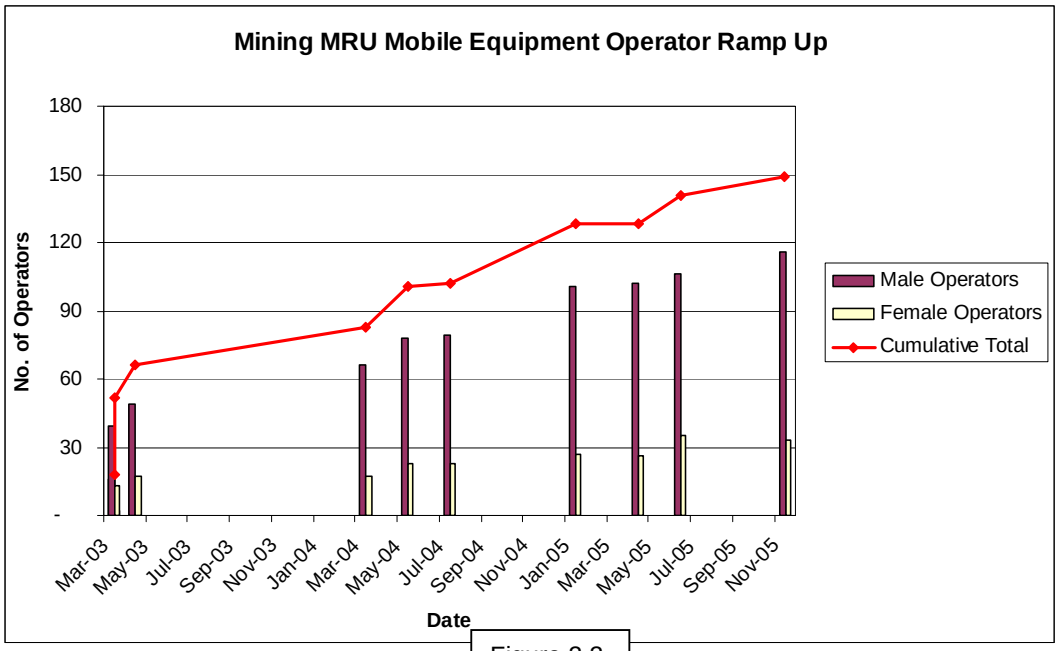


Figure 2.2

3. Objective

The objective of this study is to use incident reporting data to assess the effectiveness of safely implementing the recruitment strategy at Hail Creek. This paper then calls on incident data gathered in the mining operations as a means of assessing whether the tactics engaged to commence operations at this mine have been effective in achieving an outstanding safety culture. To achieve this the data has been queried to address the following areas:

3.1.1 Mining MRU Mobile Equipment Operator Demographic

The first point of reference is the make-up of the operator workforce included in the study. This is demonstrated in terms of operator groups based on gender and experience level. For the purposes of this paper the following definitions will apply for the experience levels:

- New employee – an employee new to the mining industry and with no previous mobile equipment operator experience
- Skilled employee – an employee new to the mining industry but has mobile equipment operator skills
- Experienced employee – an employee with previous experience as a mobile equipment operator in mines

3.1.2 General Incident Reporting

Employees are encouraged to report all forms of workplace incidents. This is spelt out at induction and reinforced through the Safety Health Management System. It is of interest to note from reporting data if there may be any bias in a particular operating group that may reflect confidence or reticence to report.

3.1.3 Injury Reports

A workplace free of injury to all employees is achieved through, amongst other things, systematic identification, assessment and control of workplace risk. Injuries incurred and reported by different operator groups need to be understood in order to determine areas in which to refine the risk identification process. Additionally, it can be difficult in mining, as a largely male dominated industry, to convince employees of the benefits of reporting minor injuries. It is therefore useful to know if there might be any groups appearing less likely to report.

3.1.4 Equipment Damage Reports

Operating equipment is about aptitude and application. Anecdotally people would suggest that a less experienced person would be more likely to have an incident whole operating equipment than an experienced person. However if the environment to learn is correct then new employees will not be any more prone than an experienced operator. Similarly, aptitude and application are not gender specific; therefore there should not be any difference in rates of incidents for equipment damage incidents for male or female operators.

3.1.5 Risk Associated with Equipment Damage Reports

Anecdotal evidence would suggest that high risk incidents tend to be had by more experienced operators, operating with fewer controls in place while the correct training environment should mitigate for risk to new employees. Study of the risk associated with equipment damage incidents for different operator groups helps to understand if this is the case or not.

3.1.6 Reporting of No Damage and Hazard Reports

A study of these reports by operator group helps to identify if there is any pattern associated the reporting of events where there is no material outcome. New employees may be less inclined to report up hazards as their confidence develops and experienced employees may be less inclined to disclose near miss events for fear of undermining their team status.

3.1.7 Length of Service and Equipment Damage Reports

It is useful to know if there is a period at some time after commencement when familiarity with the mine and the work being conducted leads to a degree of operator complacency. A study of equipment damage reports and time since commencement can demonstrate if this is the case.

4. Process:

When an incident occurs at Hail Creek Mine, whether it involves a Hail Creek employee of a contractor, the incident is to be reported and captured in accordance with the incident reporting provisions of the site Safety and Health Management System. This process is detailed in the safety standard 4.03 Incident Investigation and Reporting. The information captured on an incident report is then entered into the First Priority system, the site repository for incident information.

Available now within First Priority is a database of incidents recorded since operations began in March 2003. These have been searched to look specifically at those incidents involving mobile equipment operators in the Mining MRU to May 2005. The incident database has fields for:

- Incident type
- Key person involved
- Date and time of incident
- Incident description
- Risk rating and risk score

These incidents are categorised within the database as:

- Environment
- Equipment Damage
- Hazard
- No Damage
- Occupational Illness
- Personal Injury
- Process Flaw

This incident database has been cross-referenced to a human resources database with fields for:

- Employee Name
- Date commenced as Hail Creek employee
- Gender
- Experience level when hired

Queries have then been performed across these two datasets to establish statistics on prescribed criteria. These queries have been conducted to obtain data regarding:

- The demographic of the mobile equipment operator population
- Whether experience level and gender influence who reports incidents
- Whether experience level and gender influence who incurs an injury
- Whether experience level and gender influence equipment damage incidents

- Whether experience level and gender influence the risk associated with equipment damage incidents
- Whether experience level and gender influence the reporting of hazard and no damage events
- Whether attitude changes occur in the months after commencement.

5. Analysis:

5.1 Mobile Equipment Operator demographic:

Since recruitment began for mobile equipment operators at Hail Creek 168 people have been employed, 129 males (77%) and 29 females (23%)

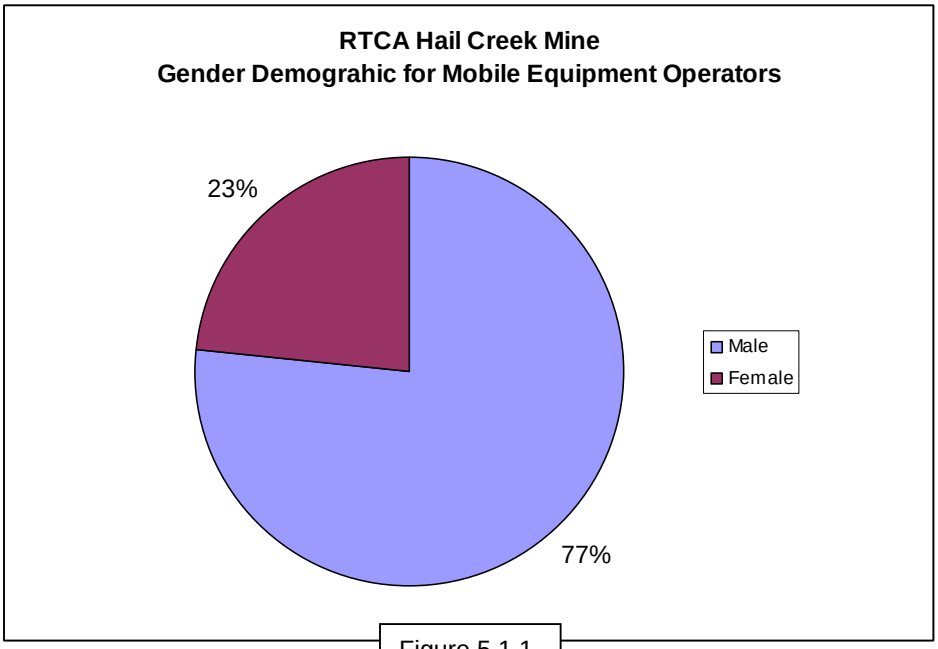


Figure 5.1.1

The experience levels of these 168 recruits are 69 (41%) have mining industry experience (ie experienced employees), 42 (25%) have some operating skills but no mining experience (ie skilled employees) and 57 (34%) have neither mine experience or operator skills (ie new employees)

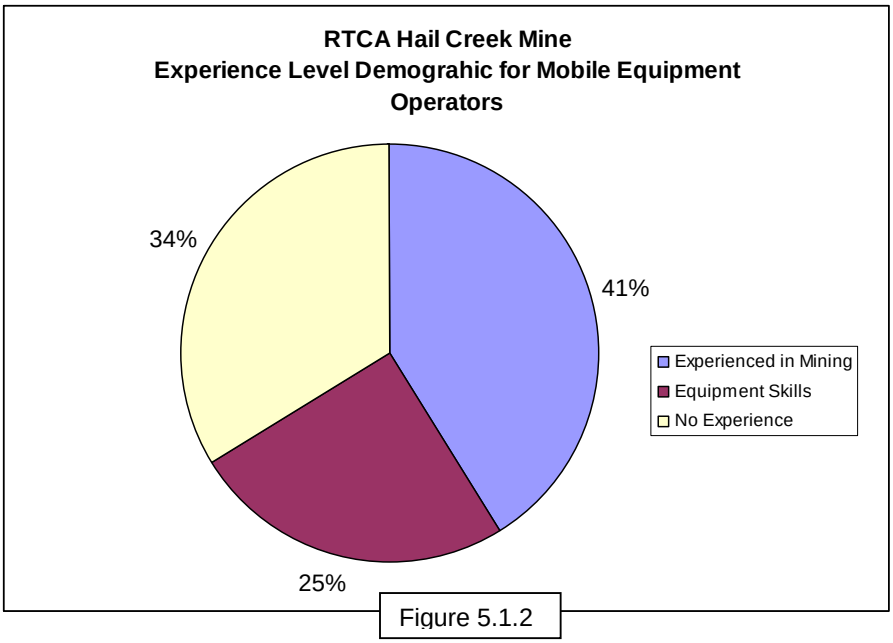


Figure 5.1.2

When the breakdown between male and female recruits is considered, it can be seen that:

- 24 (60%) of the females make up 42% of the operators with neither mine experience or operator skills
- 10 (27%) of the females make up 24% of the operators with some operating skills but not necessarily mining experience
- 5 (13%) of the females make up 7% of the operators with mining industry experience

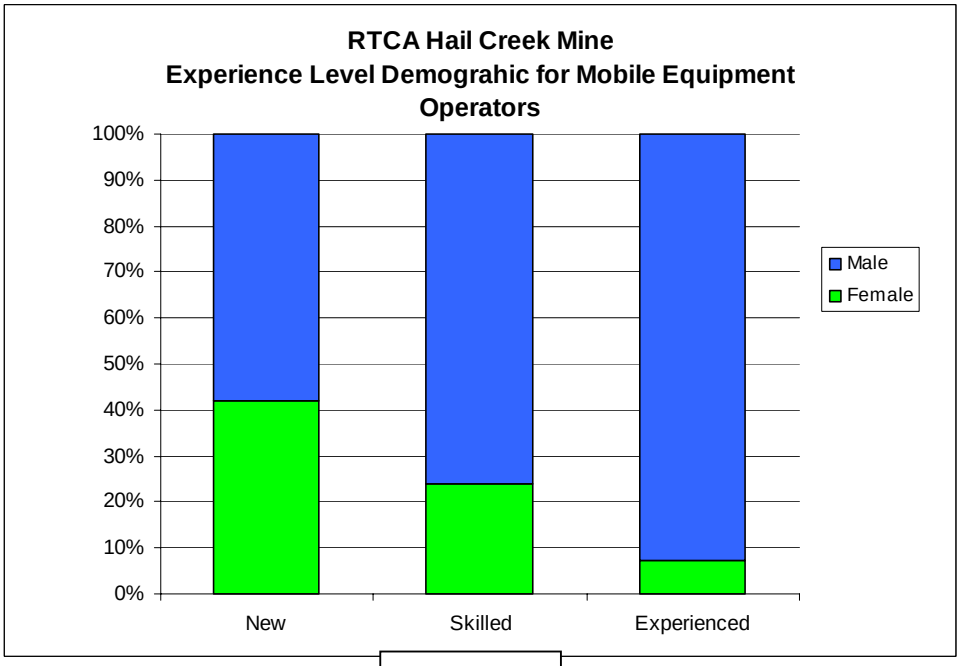


Figure 5.1.3

5.2 Incident Trends:

The analysis of the 551 incident reports concerning mobile equipment operators in the Mining MRU has been conducted.

5.2.1. Incident reporting in the Mining MRU:

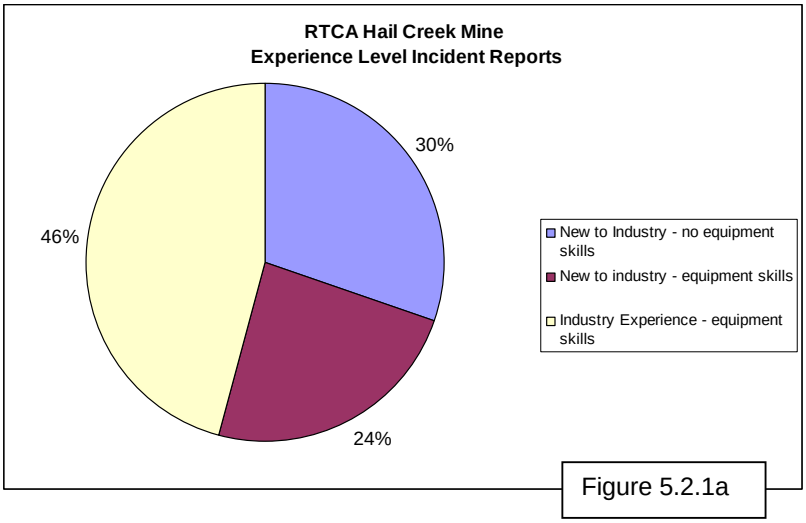


Figure 5.2.1a

A high level view of these incident statistics show 46% concern people who were employed with mining industry experience, 24% where people had some operating skills and 30% where people were new to mining and operating. Figure 5.2.1

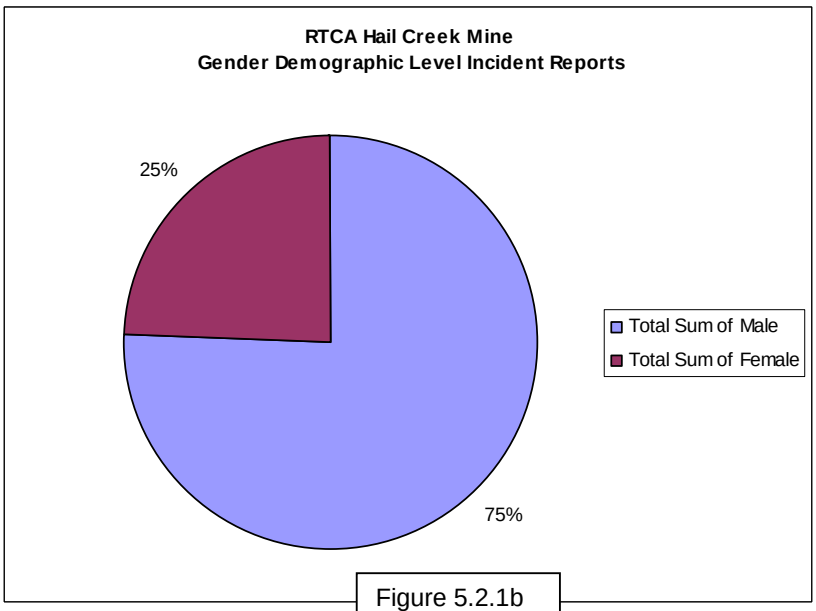


Figure 5.2.1b

The gender demographic shows that 75% of the incidents concern male operators and 25% female operators. Figure 5.2.1b

Normalising these incident occurrences over the populations for each category creates an incident rate per employee in each category. The shows a rate of 3.67 for experienced operators, 3.12 for employees employed with some operating skills and 2.93 for employees who had neither mine experience or operator skills. Figure 5.2.1c

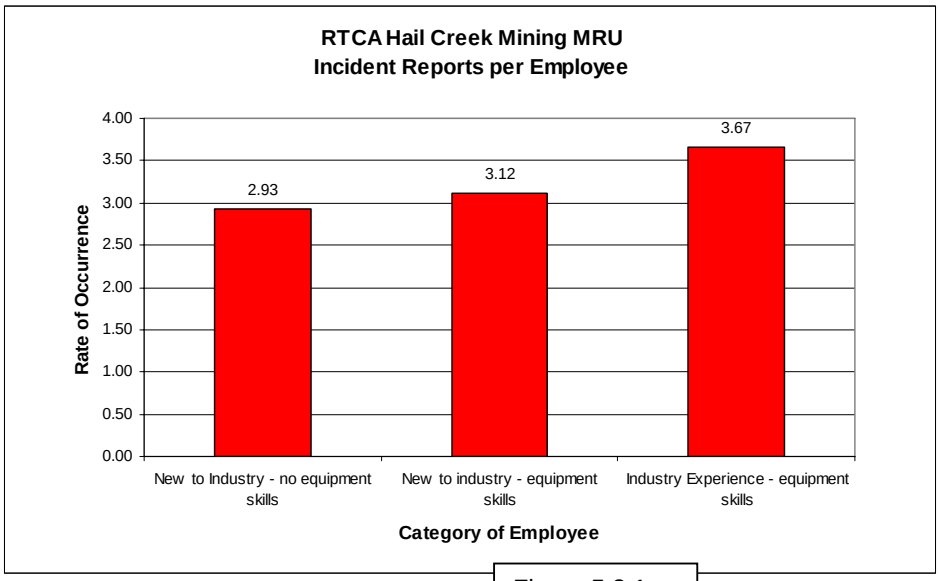


Figure 5.2.1c

Analysis of the make-up of incident categories for each experience level shows that personal injury events are 14% for new employees, compared to 7% for skilled employees and 6% for experienced employees.

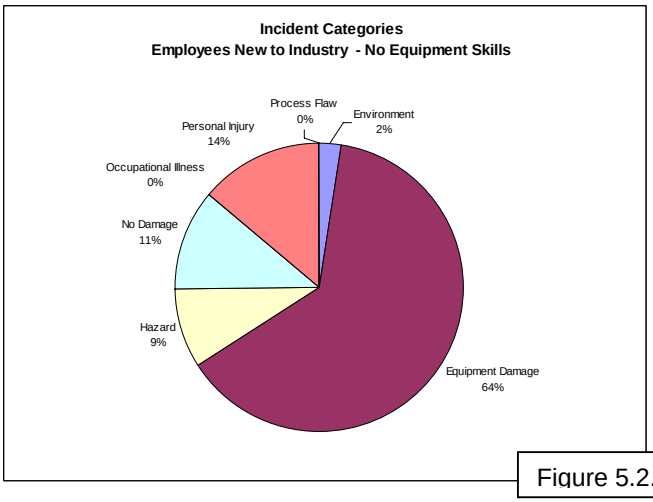


Figure 5.2.1d

Equipment damage events are 64% for new employees compared to 64% for skilled employees and 60% for experienced employees.

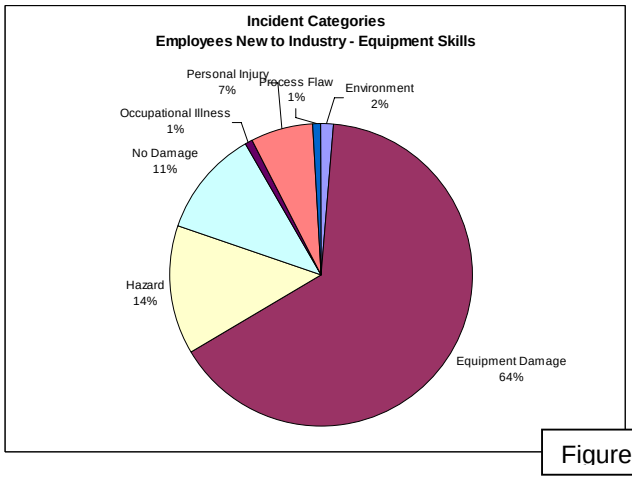


Figure 5.2.1e

Hazard and no damage reports are 20% of new employee reports compared to 25% for skilled employees and 31% for experienced employees.

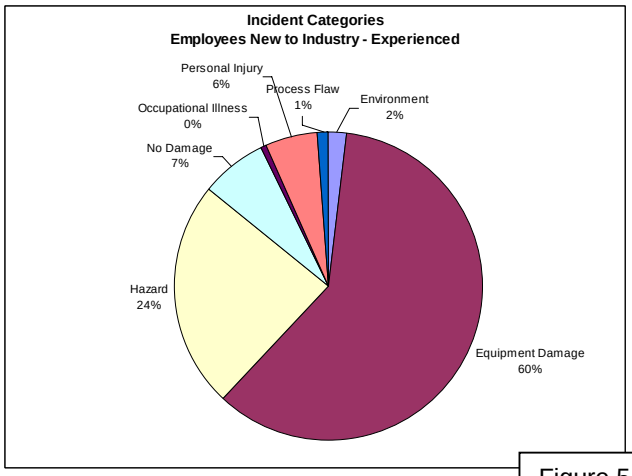


Figure 5.2.1f

5.2.2. Personal Injury occurrences within the Mining MRU

There have been 46 personal injuries incurred in the Mining MRU in the period of the study. 36 First Aid (78%), 2 Medical Treatment Injuries (4%), 3 Occupational Diseases (7%) and 2 Restricted Work Day Injuries (4%). There have been 3 injuries reported in the village (7%), these are not classified as work related injuries. Figure 5.2.2a

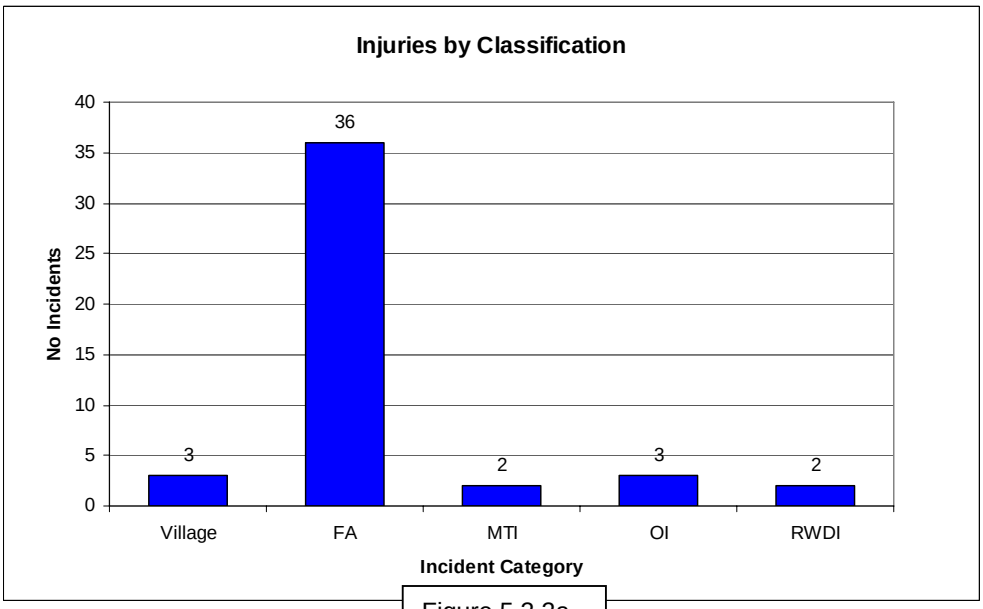


Figure 5.2.2a

The personal injury statistics show 13 (28%) concern experienced employees, 9 (20%) skilled employees and 24 (52%) where new employees. Figure 5.2.2b

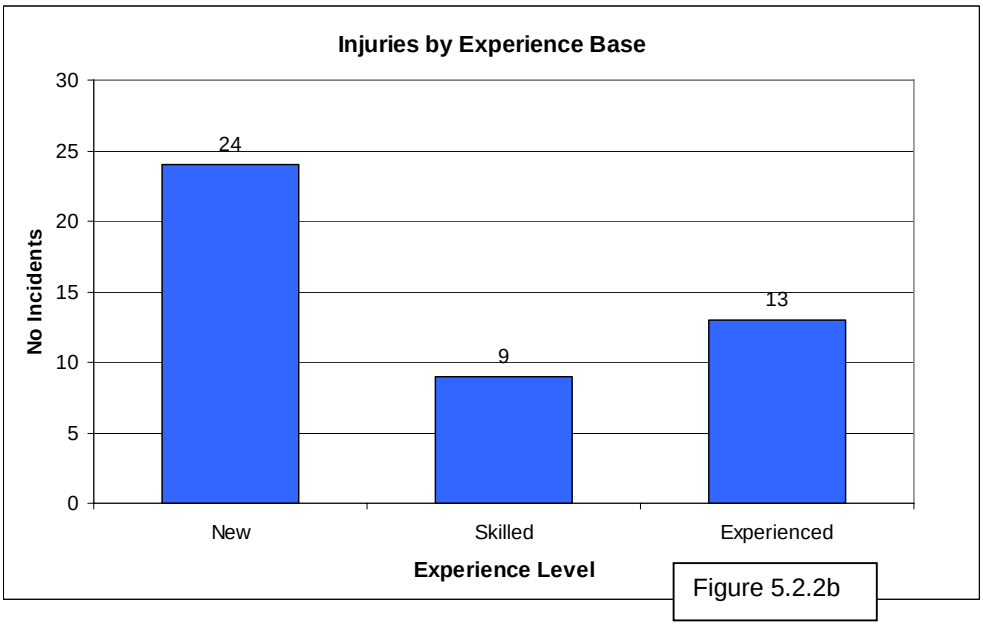


Figure 5.2.2b

When normalised for the population of operators in each experience level, rates of occurrence for each experience level can be seen. The rate of injury for a new employee is 0.42 injuries per employee, twice that for a skilled or experienced employee. Figure 5.2.2c

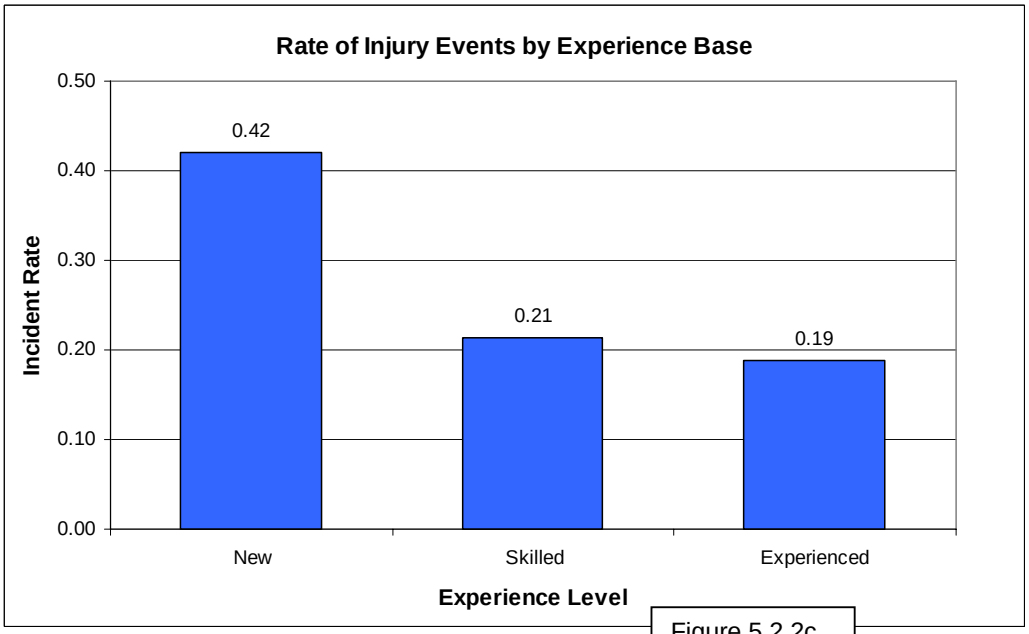


Figure 5.2.2c

Looking at these personal injury incidents on a gender basis it can be seen that of the 46 personal injury incidents, 23 (50%) have been incurred by males and 23 (50%) by females. Figure 5.2.2d

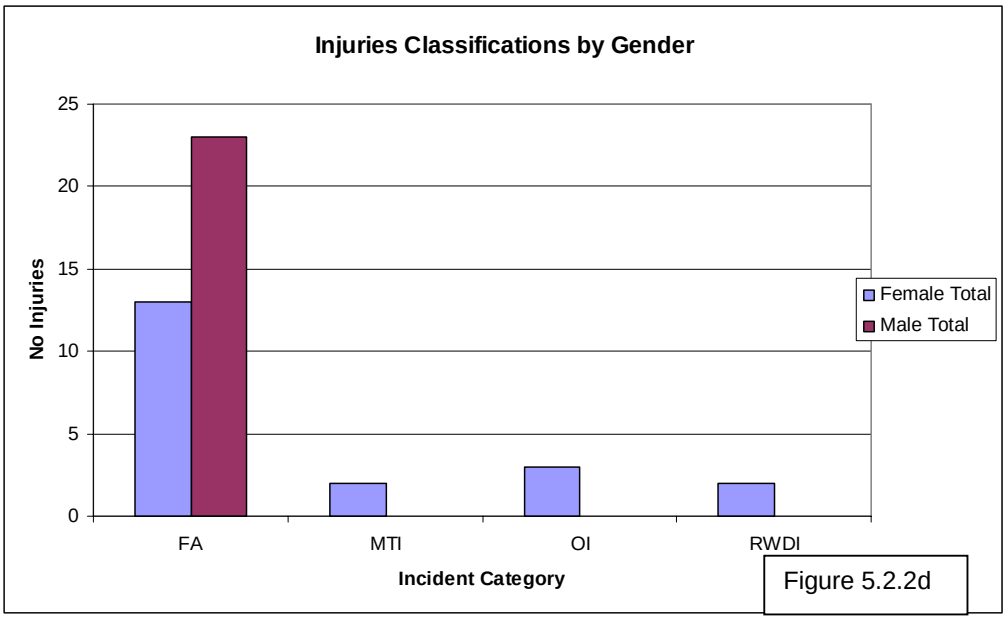


Figure 5.2.2d

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Normalising these incident occurrences for the populations of each gender creates an injury rate per employee in each category of injury for each gender. This shows that the females are 2 times more likely to have a first aid injury than a male. Rate comparisons are not conducted for Medical Treatment or Restricted Work Day Injuries as no males have incurred injuries of this nature and the samples are too small. Figure 5.2.2e

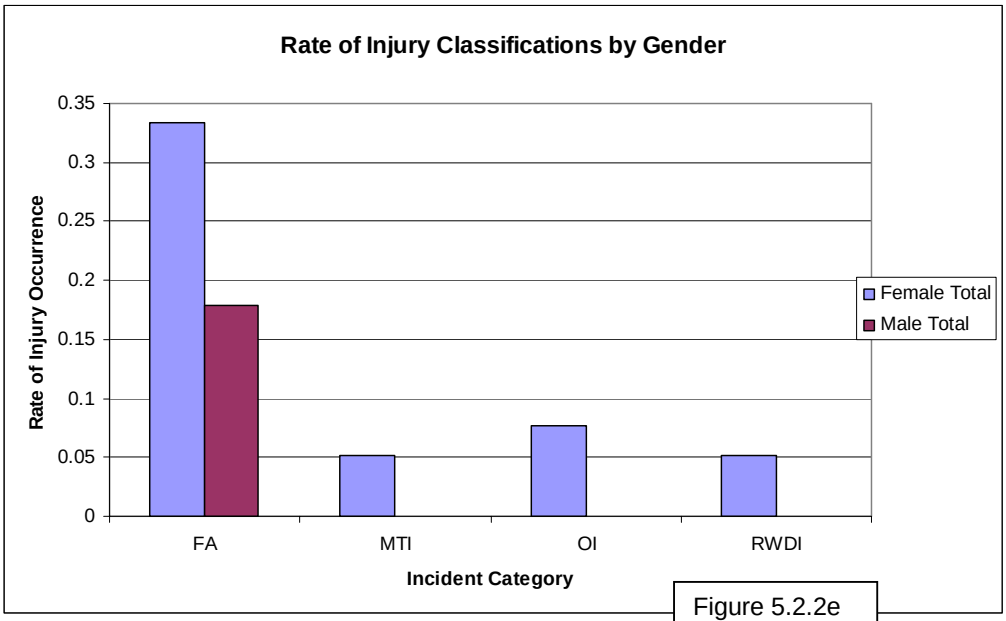

Figure 5.2.2e

Analysis of the experience level at which "serious injuries", namely medical treatment and restricted work day injuries, have been incurred shows 2 concern experienced employees, 1 skilled employee and 1 new employees. All these injuries have been incurred by female operators.

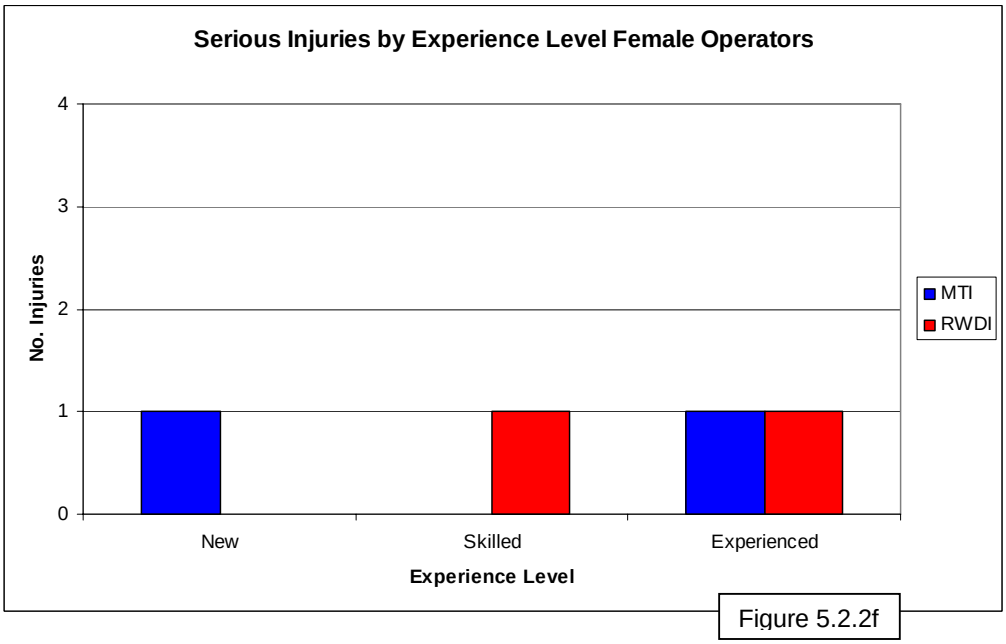

Figure 5.2.2f

The nature of each of these serious injuries has been soft tissue damage from a sprain or strain. Both the Medical Treatment Injuries have been incurred by exertion of human energy in a lifting situation. Both the Restricted Workday Injuries have been the result of vehicle energy – jolting and jarring – when dumptrucks moved abruptly and shook the operator.

5.2.3. Equipment Damage Incidents in the Mining MRU

Equipment damage events are classified when the outcome from the incident is damage to plant or equipment and no injury has occurred.
An analysis of the Equipment Damage incidents shows that 152 (44%) involve experienced employees, 85 (25%) skilled employees and 106 (31%) new employees. Figure 4.2.3a

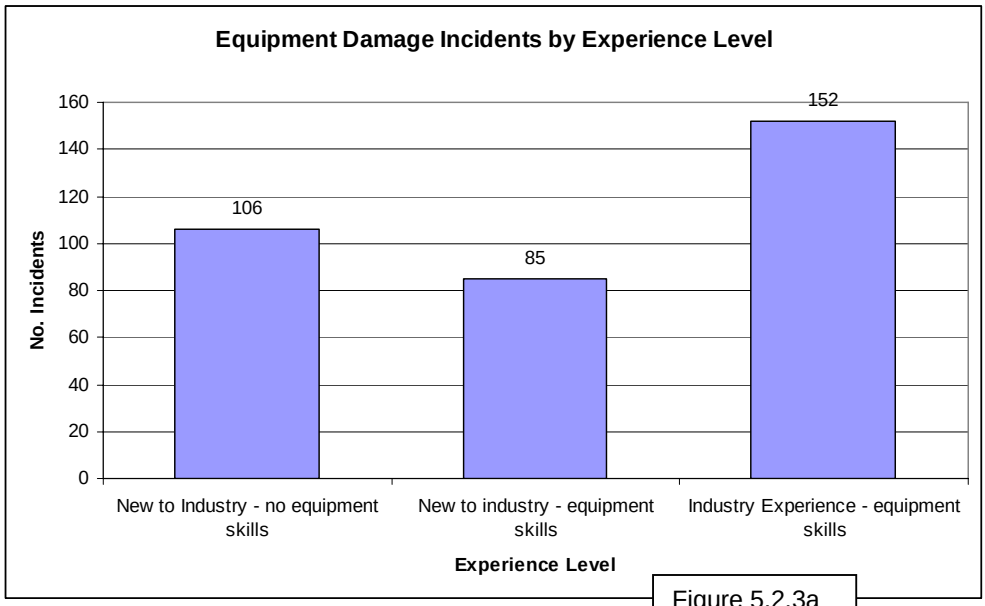

Figure 5.2.3a

When these totals are normalised for the operator populations in each category, the rate of incidents shows that the rate of injury per operator increases from 1.86 for a new employee, to 2.02 for a skilled operator, to 2.20 for an experienced mining operator. Figure 5.2.3b

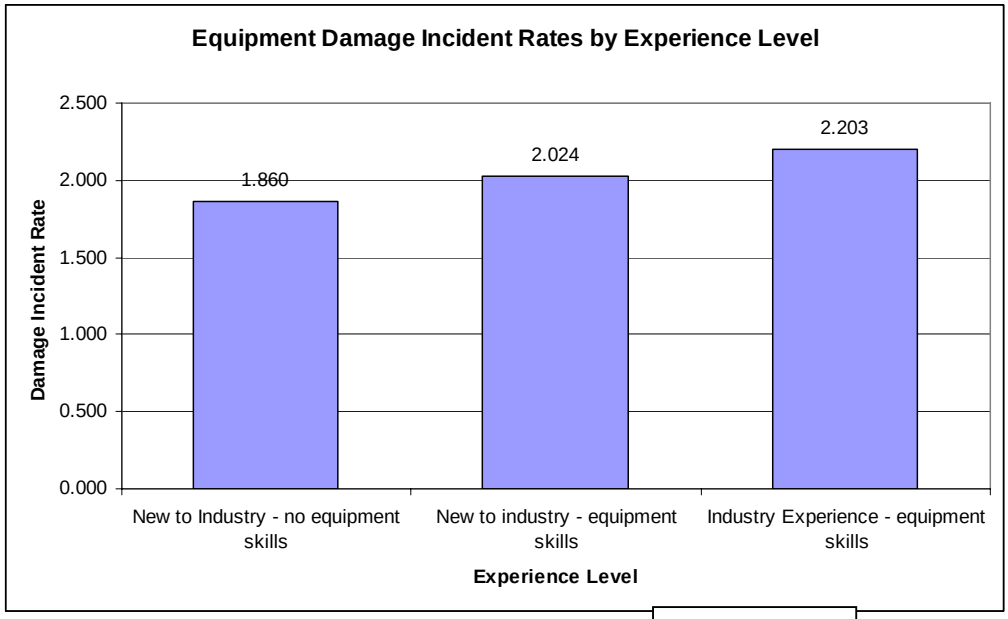

Figure 5.2.3b

If these rates are then looked at on a gender basis they show marginal differences for male and female through each experience level. Figure 5.2.3c

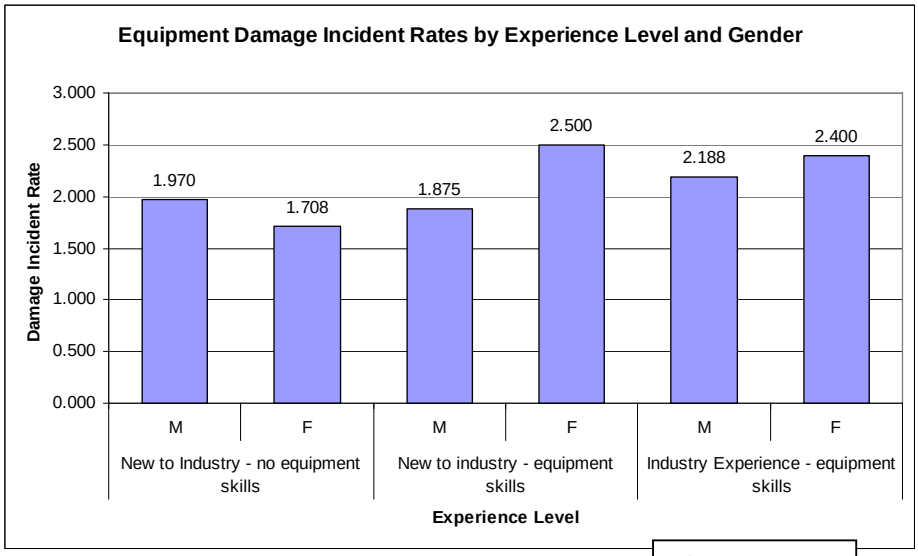

Figure 5.2.3c

5.2.4. Risk Rating of Equipment Damage Incidents

While recognising that risk rating of incidents can be a subjective process, a review has been conducted of the risk rating applied to the 343 equipment damage incidents. The number of incidents falling into each risk category generally supports the "incident pyramid" model. Figure 5.2.4a

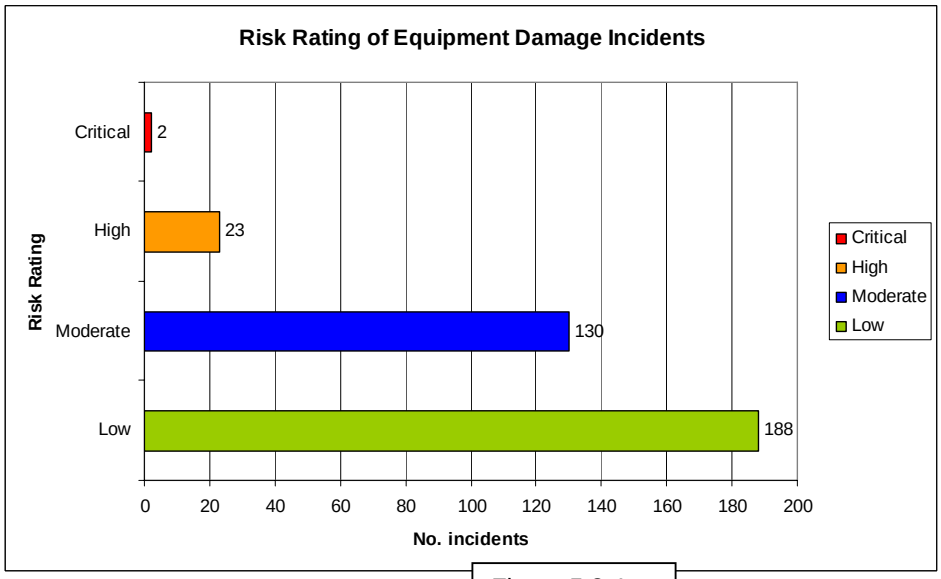

Figure 5.2.4a

It is useful to look at how experience level might impact on the risk rating of an incident. Anecdotal evidence can suggest that given the inherent hazards in a mine the inexperienced, unskilled operator will be subject to more high risk hazards. The rate of occurrence of equipment damage incidents in each risk

category is shown for experience level. Generally these rates do not change for experience level, the greatest difference seen in the high risk incidents where the rate for an experienced employee (0.17) is 42% more than that for a new employee (0.12). Figure 5.2.4b.

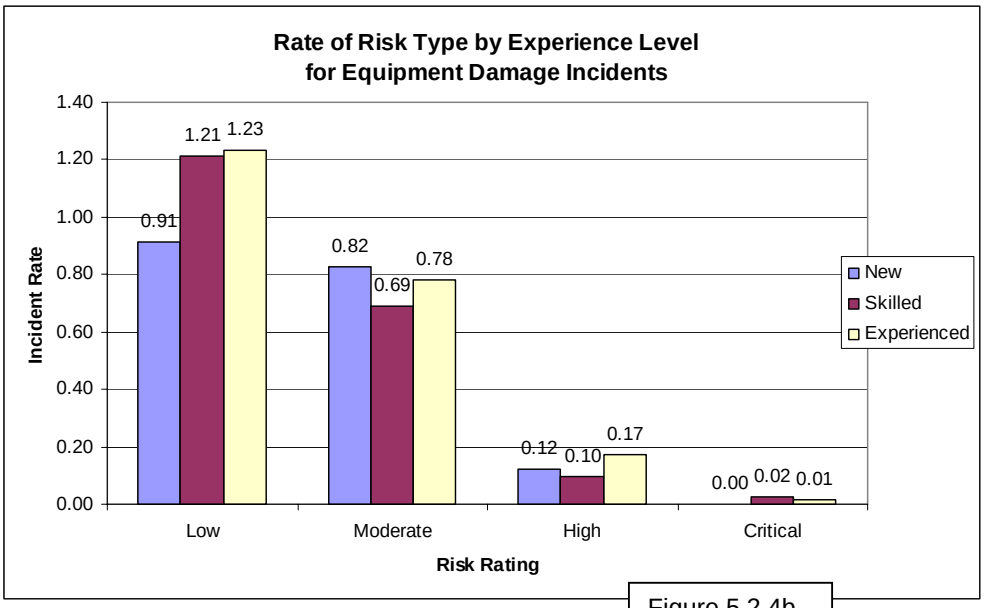

Figure 5.2.4b

The rate of occurrence of equipment damage incidents in each risk category is assessed by gender. The female rate for low and moderate incidents is the same while the male rate drops from 1.18 for low to 0.73 for moderate. There is little difference between male and female in the rate for high incidents, 0.13 and 0.15. Figure 5.2.4c.

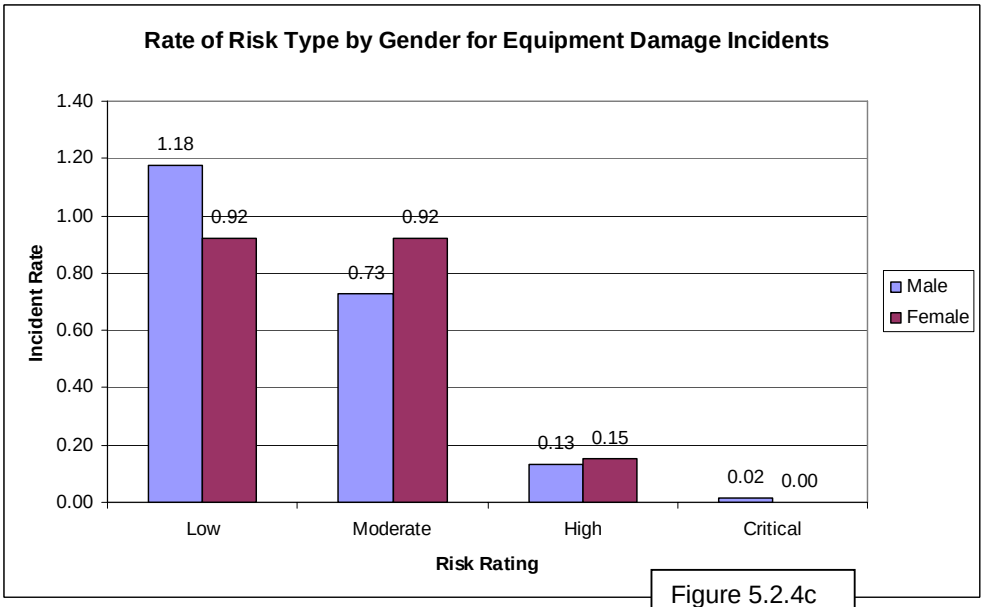

Figure 5.2.4c

5.2.5. Reporting of Hazards and No Damage Incidents

It is useful to look at the reporting of hazard and no damage incidents to assess disclosure in team culture and recognition of hazards. The reports for occurrences of Hazard and No Damage incidents were assessed by experience level. It can be seen that the rate of Hazard reports per operator increases from 0.26 for a new employee, to 0.43 for a skilled employee, to 0.87 for an experienced employee.

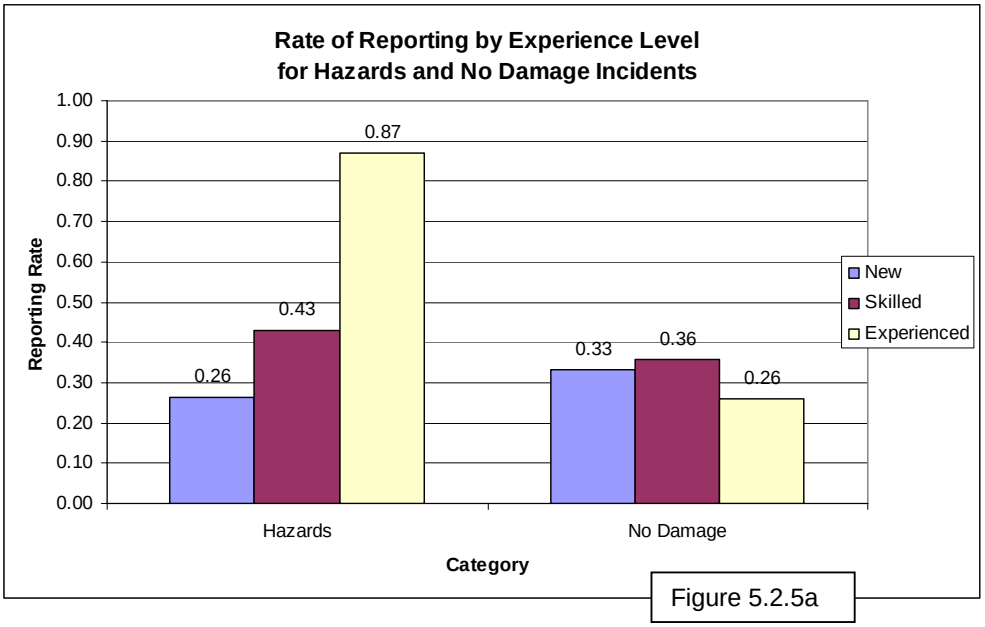

Figure 5.2.5a

At the same time it is seen that the rate No damage reports per operator varies from 0.33 for a new employee, to 0.36 for a skilled employee, to 0.26 for an experienced employee. Figure 5.2.5a

When the reports for occurrences of Hazard and No Damage incidents were assessed by gender, males reported hazards on a 27% more frequent basis and females reported no damage events on a 10% more frequent basis. Figure 5.2.5b

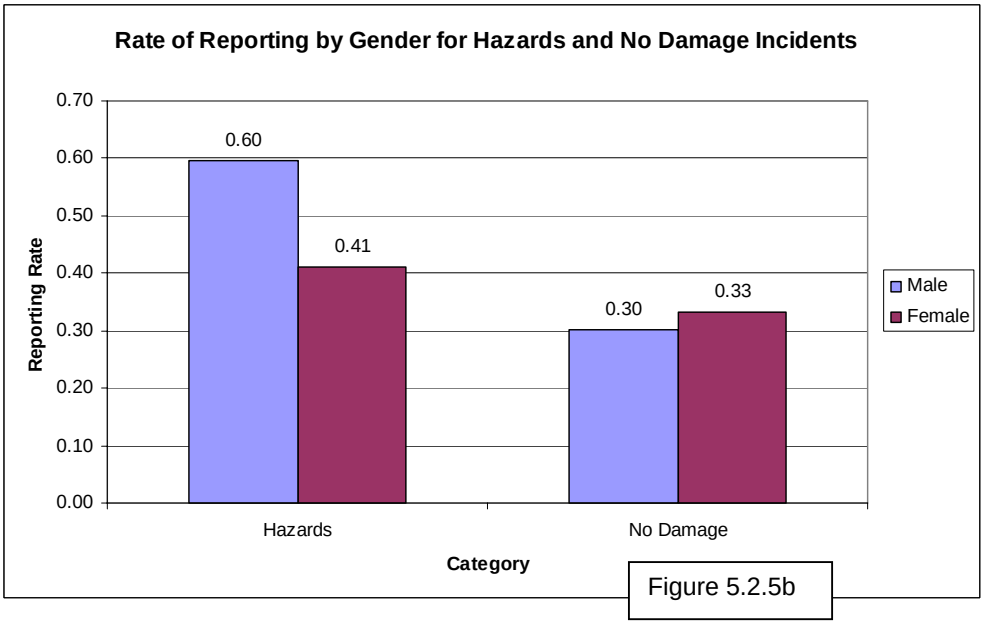

Figure 5.2.5b

5.2.6 Incident rate change after initial commencement Period

Analysis has been performed on the equipment damage reports to assess whether there is any pattern to suggest that incidents are more likely to occur after the initial employment period of 3 months passes. This analysis is useful to try and gauge if a level of complacency may set in once a new employee has some rudimentary skill and exposure to the mine or if experienced employees may be modifying behaviour through the "probation period" in their staff contract.

When the entire workforce is considered there appears to be a spike in incident rate for employees in the 9-12 month period where the rate is twice that of the preceding and proceeding periods. Figure 5.2.6a.

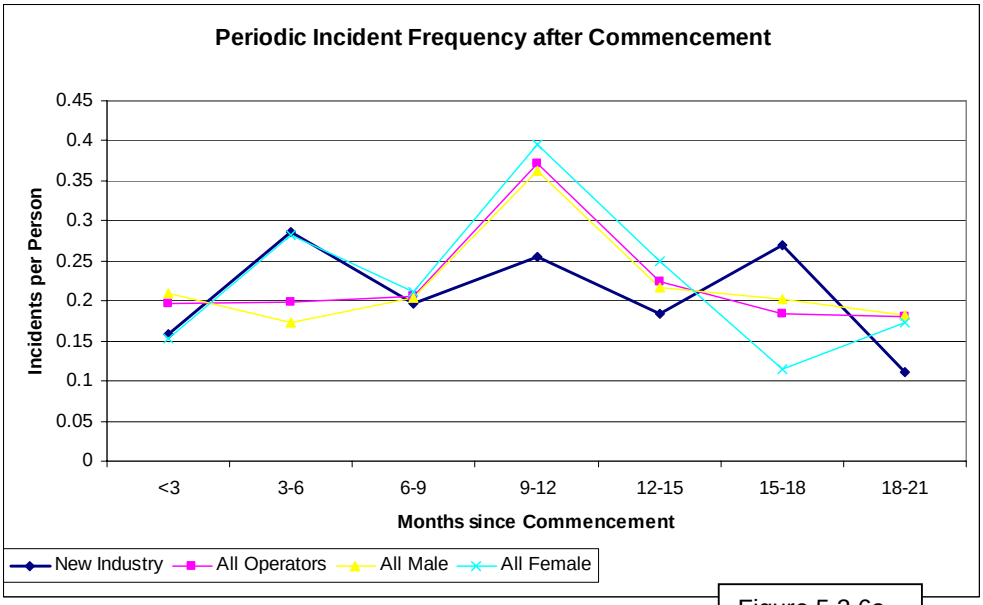

Figure 5.2.6a

The rate for new employees doubles in the first two periods, then oscillates until it drops to more than half in the 18-21 month period. This would appear consistent with the lower levels of unsupervised competence in the second period and the subsequent cycle of introduction to new skills within the first two years.

6. Results

6.1 Mining MRU Mobile Equipment Operator Demographic

Over the period of the study the percentage of new, skilled and experienced employees has not quite reflected the target experience levels. This reflects the dilemma of trying to maintain a target ratio in a period of high production demand on the operation. Inevitably, more experienced employees have been recruited. When trying to maintain a proportion of 25% female mobile equipment operators in a mine operator workforce, the pool of experienced female candidates is small and has proven to be more transient. 60% of female employees are new to operating and mining and they make up 42% of the inexperienced employees.

6.2 General Incident Reporting

Experience level does not appear to have any influence on the volume of incident reporting. The proportion of incidents from each experience level generally support the proportion of employees in those experience levels. The proportion of incidents from male and female employee groups generally represents the proportion of employees in those groups.

6.3 Injury Reports

Experience level has had an influence on the incidence of first aid incidents where a new employee is 2 times more likely to incur a first aid injury than a skilled or experienced employee. In addition to this a new female employee is 2 times more likely to incur a first aid injury than a new male employee. These results indicate the mine has more work to do in determining risk associated with equipment operating work carried out by female operators. At the same time, there needs to be further evaluation to understand if there is any reluctance in the male and more experienced operator groups not to report first aid injuries.

Female employees from each experience level incurred the 4 serious injuries. All are sprain/strain injuries, 2 from human exertion and 2 from jolting/ jarring while operating trucks. Female employees exposure to truck driving operations is heavily weighted and in light of these injuries considerable effort has been made to eliminate practices that contribute to jolting/jarring of trucks. In particular, excavator bucket contact being made with the trucks during the loading process.

6.4 Equipment Damage Reports

It does not appear that low experience level influences the occurrence of equipment damage incidents. The data suggests that rates of equipment damage are higher in experienced employees. However, a rate of 2 damage incidents per employee over the period of the study is too high. This indicates that the training environment can be improved for the new employees. It also indicates a need to evaluate how competence in experienced operators is determined as poor practices and behaviour from the past are not being identified and corrected

Gender does not appear to influence the occurrence of equipment damage incidents. The rate of equipment damage incident is slightly higher for skilled and experienced female employees however these are very small groups.

6.5 Risk Associated with Equipment Damage Reports

The risk rating of an equipment damage incident does not appear to be influenced by experience level. Risk rating is subjective however the rates of the three experience level groups are generally aligned through the risk categories.

The risk rating of equipment damage incidents while not appearing to be influenced by gender does require further investigation to determine if multiple incidents for one or two pieces of plant or individuals are driving up the likelihood and hence risk rating on some female incidents.

6.6 Reporting of No Damage and Hazard Reports

The data shows experienced employees report hazards 3 times more frequently than new employees. Given that new employees are learning about the environment and the nature of hazards in the work place, their confidence may take time to develop to the point where they are comfortable reporting hazards.

Every effort must be made and facility provided by the leaders and experienced team members to ensure this time is kept to a minimum.

New employees report no damage events at a rate 30% more than experienced employees. Given that experienced employees generally perform more complex work and the rate of equipment damage incidents is high, there would appear to be opportunity for more disclosure by the experienced operator group.

6.7 Length of Service and Equipment Damage Reports

The likelihood of an equipment damage incident increases 2 fold for all employees in the 9 –12 month period from commencement of employment. This trend is consistent for both male and female employees. It does not indicate behaviour is being modified during probation however does highlight a need to develop and implement additional controls for an employee intake as it approaches the 9 month mark. These controls can be applied to the most recent intake.

7. Conclusions

While the study is not definitive it does offer useful direction for the purpose of improving safety outcomes in the mine. Further risk assessment of the work environment and activities is required to reduce the exposure and incidence of female, and hence all employee, injuries. The training programme for new employees can be improved along with assessment processes for experienced employees to reduce the total number of equipment damage incidents. The environment for reporting hazards and no damage incidents can be improved. Nine months of employment looks to be a critical milestone for all employees so this should be considered in the mine risk assessment processes.

The safety performance in the Mining MRU has been encouraging to date and management of the employment demographic has contributed to this. Attention to the areas raised by this study will further improve the effectiveness of safely implementing the employment strategy for mobile equipment operators at the mine.

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