



**MANAGING THE AGEING WORKFORCE: ISSUES AND OPPORTUNITIES FOR THE  
QUEENSLAND COAL MINING INDUSTRY**

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# **Managing the Ageing Workforce: Issues and Opportunities for the Queensland Coal Mining Industry**

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## **Abstract**

Ageing of the workforce, with more than 80% of Australian workforce growth between 1998 and 2016 projected to be in those over 45 (ABS, 1999), is a key issue in coal mining. New strategies based on an understanding of the match between the workplace and the older worker are needed to address the relatively high attrition rates of older workers, the significant level of impairment and reduction in the quality of life in retirement, especially with fewer younger workers entering the industry.

Queensland and New South Wales data shows that workers over 40 have a higher incidence of musculoskeletal injury, more severe injuries and disability, require more intensive medical care, and take longer to return to work than their younger counterparts. There are also significant costs e.g. hospitalization, lost productivity and loss of independence associated with injury to older workers.

Overall, industries have often 'managed' the older worker issue through potentially discriminatory redundancies, particularly in recessionary periods. Older workers may also leave because of impairment or disability from cumulative exposure to adverse working conditions. Currently, the lack of credible exit data in coal-mining makes specific comparison difficult. Data is presented on the relative absence of accommodation strategies for older coal-miners in Qld and NSW, and consideration is given to measures in addition to job reassignment and allocation of less physically demanding work, the predominant methods currently used.

## **Introduction**

A significant increase in the average age of the global workforce is taking place and many countries (including those in North America, Europe, and Australasia, together with parts of Asia, such as Japan and Singapore) are experiencing a large increase in the proportion of workers in the age groups of 45-60 and older. In Australia, more than 80% of the projected workforce growth between 1998 and 2016 will be in those over 45 years of age (ABS, 1999). Ageing of the workforce is also identified as a key issue in the coal mining industry and concern has been raised at industry meetings of the relatively high attrition rates of older workers, their significant level of impairment and the reduced numbers of younger workers entering the industry. Older workers bring greater experience to their work, and are often irreplaceable because of their high skills levels and because of declining numbers of younger workers in many countries. However, this demographic change presents major challenges in the organisation of work and the workplace to accommodate age related changes in work ability.

Industries at large have managed the issue of the ageing workforce - particularly in recessionary periods - by reducing the size of the workforce through retrenchment of older workers. There is also evidence from other industries to suggest that older workers leave the industry because of impairment or disability, and reduced capacity to continue in their position, and do so as a function of cumulative exposure to adverse working conditions throughout their working life (Turner, 2000). At this time the lack of credible exit or attrition data in the mining industry makes more detailed commentary on this issue difficult.

Thus, new strategies to keep productive workers working longer are required, and these must be based on greater understanding of the match between the workplace and the physiological and psychological changes characteristic of the older worker. Failure to achieve this match may adversely affect productivity and longer term health, since work related illnesses or injuries in which work design and work organisation are significant factors (such as stress and musculoskeletal disorders) are experienced more adversely by older than younger workers. These may be a significant cause of early departure from the industry (Griffiths, 1999). Coal-miners may also carry some of the adverse effects of their working life into retirement. A recent French study indicating that one-third of retired coal miners with exercise dyspnoea had moderately impaired exercise capacity irrespective of their pulmonary function scores (Favre et al., 2002).

Management of an ageing workforce is a complex issue and, to be effective, needs basic knowledge of the relationship between work ability and work demands. Limited information is available in this area for the Australian mining industry, consequently this presentation will review relevant information from overseas, and identify a number of priorities being considered in relation to current research programs being initiated under Injury Prevention and Control (Australia) in collaboration with members of the Australian mining industry, and supported by the Joint Coal Board Health and Safety Trust.

Some of the data presented in the following section come from two surveys: one of just under 200 coal-miners from three underground mines in Queensland, focussing on major work tasks and their physical demands, and a second completed by occupational health and safety managers from a sample of open-cut and underground mines throughout Queensland and New South Wales, representing a total of 22 pits and over 3,800 miners. This second survey addressed a range of occupational health and safety issues with a view to identifying emerging issues and areas needing research. A number of questions in each survey concerned worker age directly, or could be analysed by worker age subsequently. These are presented in four sections, below.

### 1. Demographics

It is widely recognised that the workforce in coal-mining is becoming older, as is the case in a number of industries. Figure 1 shows ABS data depicting the age distribution of miners in Queensland and New South Wales, a particular feature of which is that the demographic structure in New South Wales is more heavily skewed towards the older worker.

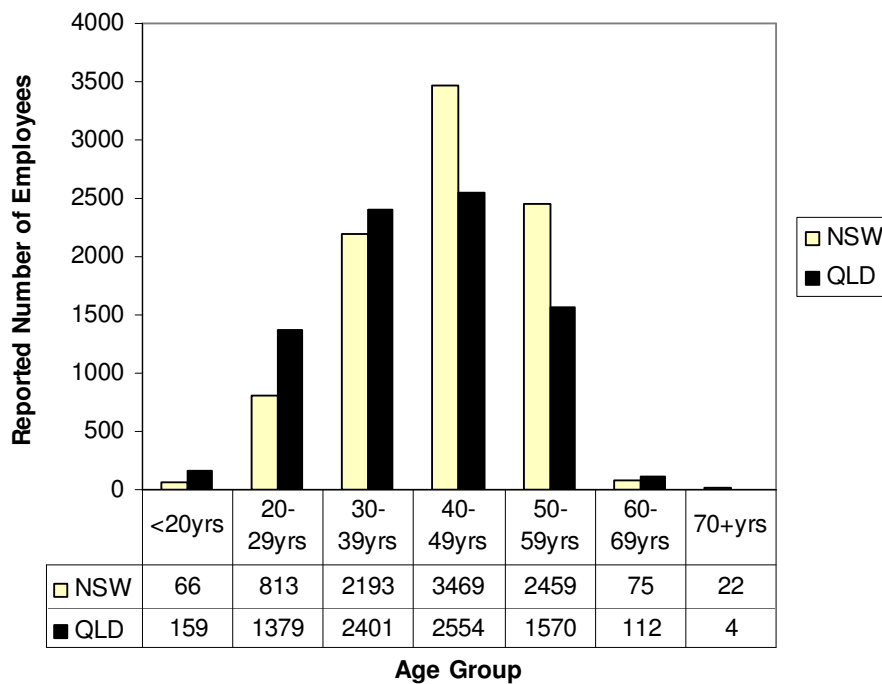
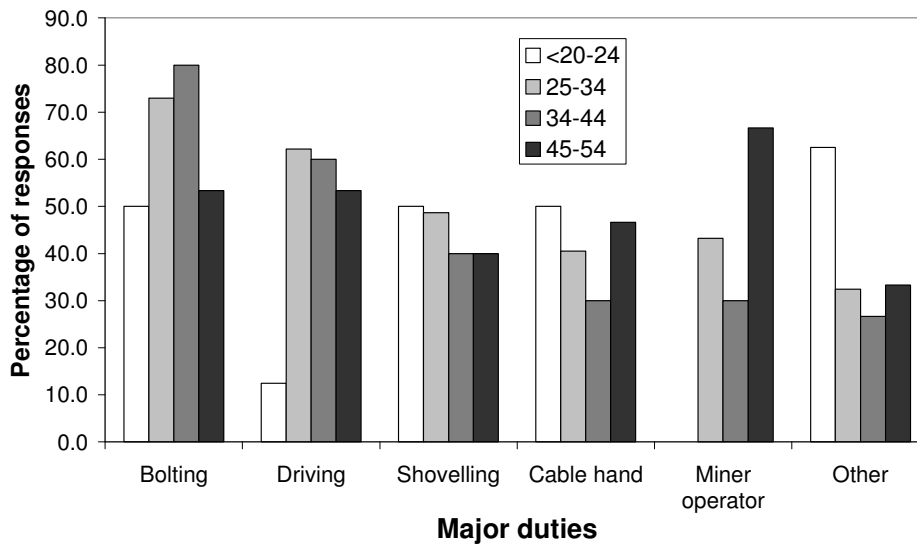


Figure 1. Age distribution of miners in New South Wales and Queensland (Source: ABS, 2001).

### 2. Work duties and tasks

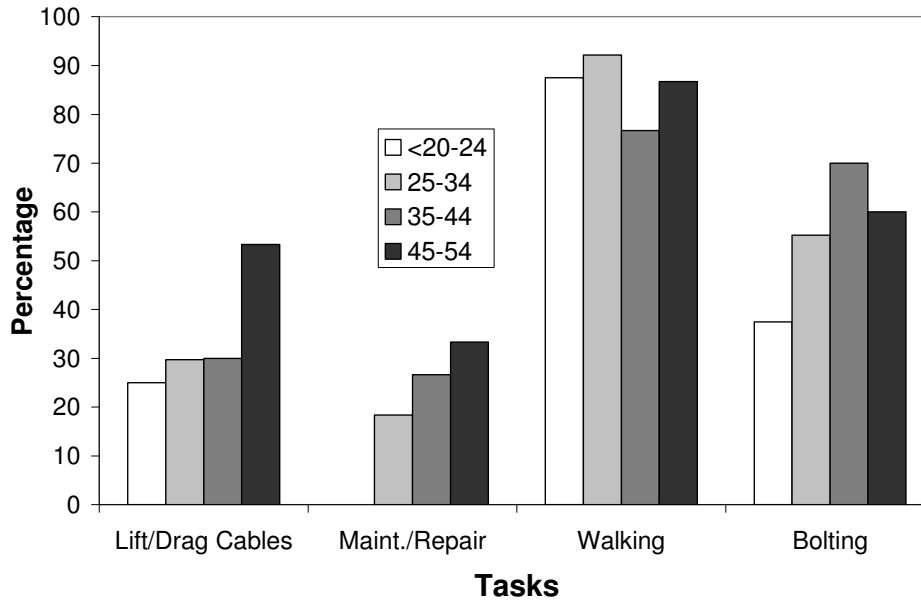
Adjusting the workload and work environment to accommodate the older worker are strategies commonly identified as essential in retaining older workers. To gain some insight into the extent to which these strategies are used in Queensland and NSW mines, questions were included in the survey which sought information on the work duties and tasks of miners of different age. Since age and experience are not independent, any insights into age effects need to be based on analyses of workers in the same job classification. For example, while there are some younger deputies and

supervisors at many pits, the majority are older and more experienced (modal age group 35-39 in the current study, as opposed to fitters/mechanics, whose modal age was 25-29). In figures 2 & 3, only those miners classified as *operator/maintainers* are included, and *deputies, supervisors, electricians, fitters and maintenance only staff* are specifically excluded. The operator/maintainer category covers both development and longwall operations. While some of the major duties in this group were shared quite evenly between age groups, Figure 2 shows some systematic differences. Younger miners were much less likely to have driving as a specific duty, while older miners were substantially more likely to be formally assigned operation of the continuous miner. Bolting exemplified duties with a less clear-cut pattern, increasing from the 20-24 to the 34-44 age group, but falling again for the 45-54 group. The relatively high reporting rate of “other” duties for younger miners appeared to consist of general service, and general repair and maintenance tasks. By contrast, older miners listed a large range of more specialised functions, presumably reflecting increased skill and experience, including operation of a variety of equipment and vehicles, and some inspection, training, and supervisory tasks.



**Figure 2. Major duties of underground “operator/maintainers” by age group.**

When a range of specific tasks was analysed, a similar pattern was seen (e.g. compare bolting in Figures 2 and 3). For many tasks, few age differences were observed with respect to self-reported high frequency activities (e.g. walking, Figure 3). On the other hand, *younger* miners generally reported performing some physically demanding tasks (e.g. maintenance and repair, lifting and dragging cables) *less* frequently than the other age groups. However, there were negligible differences in the reported durations of these tasks when they were performed, nor did the age groups rate the intensity of the tasks differently.



**Figure 3. Percentage of selected high frequency activities by age group.**

In the case of underground operations, age influences the frequency of at least some tasks, even within the single largest job classification of “operator/maintainer”. It was also clear that there were very few tasks that older miners performed substantially less, and some they performed as much or more than younger miners, including some of the more physically demanding activities such as shovelling and lifting and dragging cables and monorail. Thus there is little evidence that, as age increases, older miners are systematically exposed to less physically demanding work *within* a single work category.

### **3. Accommodating the older worker**

While physical capacity decreases naturally with age, this preliminary data suggests that the physical demands of the job remain relatively constant. The extent of age-related physical changes is clearly varied across individuals and performance dimensions (Spirduso, 1995). To gauge the typical extent of these changes, we refer to the latest results from a 16-year longitudinal study of Finnish municipal workers whose initial average age was 51.5 years, (Savinainen et al., 2004). Performance declines averaged 20%, varying between 11.6 and 33.7% in the males. In the same study, those who were physically active had the highest physical function. In general, however, relative to the younger worker, any reserves for recovery are rapidly depleted leaving the older employee more susceptible to fatigue and other adverse symptoms. This situation, coupled with the increased potential for chronic disease, decreases the safety margin which protects against injury and work related disease. To reduce the possible adverse effects of work it is necessary to modify tasks such that the demands are consistent with the reduced physical capacity of the worker. But changes should be made on the basis of good information. In discussing the needs of the older worker in terms of exposure to musculoskeletal disorders, contemporary thinking stresses this need for knowledge of the job:

*‘Because the illness experience in later life tends to be more chronic and progressive in nature, and because with age we lose adaptive and restorative capacity, assessments need to go beyond simple diagnosis. Practitioners should also try to estimate the ability to function in the work environment to which the client must return. This will, of course, require a more comprehensive assessment of the demands and support characteristic of such environments, an endeavour that transcends usual practice’ Hannson et al. (2004).*

In the case of one of the important capacities for mining work, maximal oxygen uptake (a measure of aerobic capacity) has been shown to decline by 1-2% per year from its peak value in young adulthood. It has been suggested that the threshold for physical work across an 8-hour shift should be set at 33%

MaxVO<sub>2</sub>. A lower work intensity should be set for a longer working shift such as 12 hours which would be set at 28% of maxVO<sub>2</sub> (Wu & Wang, 2002). In one study of underground coal miners in Spain, it was found that the average actual heart rate over the working shift was unrelated to age, but there was a weak association with heart rate over the shift relative to maximum. This would suggest that older workers are experiencing loads which are at least as challenging to the cardiovascular system as for younger workers, and relatively speaking, more challenging (Montoliu et al. 1995).

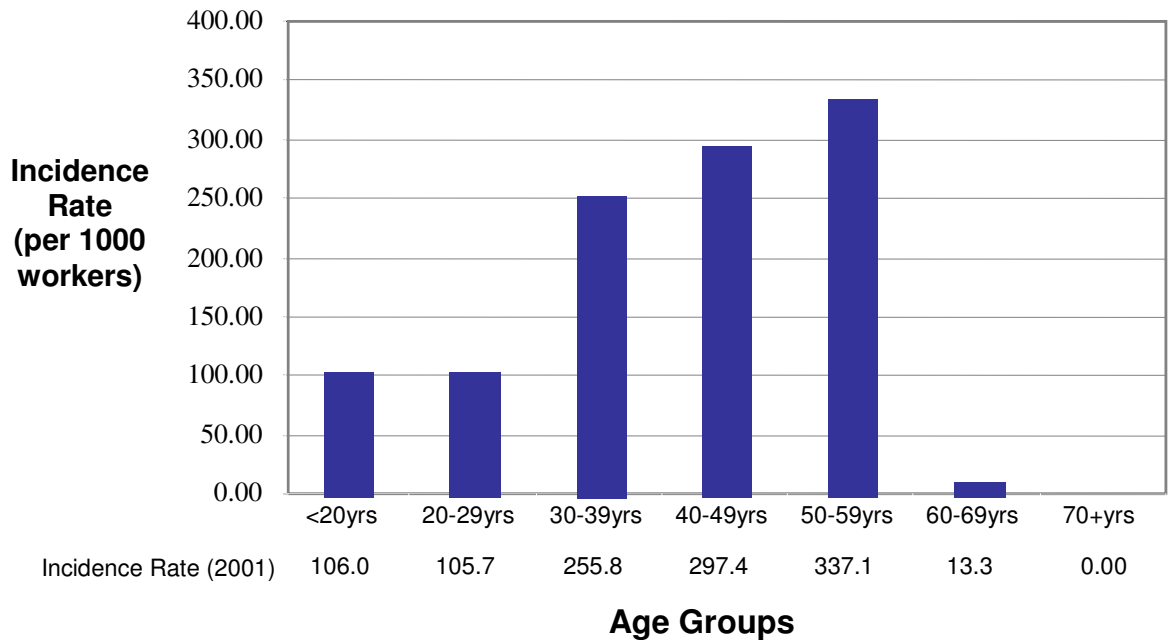
Studies of the older worker in demanding jobs are still rare, but research on the physiological demands of specific jobs can underscore the capacity of older workers to remain in these occupations, provided that suitable accommodation is made. For example, an early study of long-line fishermen showed that, like mining, it is characterised by short periods of high demand intense work (heart rates of up to 165 beats per minute), but that it need not be considered unsuitable for older workers '*provided an effective system of job rotation is practiced and the size of the crew is large enough*' (Rodahl & Vokaz, 1977). Job rotation practices in coal-mining exist, but are not always based on well-established criteria, and crew size is a recurring issue.

Most industries do not adjust the work of the older employee in this or other ways, and a survey of countries in the European Union indicated that relatively few difference were found between younger and older workers in their exposure to vibration, noise and temperature and physical work loads (Ilmarinen, 1999). Importantly, workers over 45 years were generally able to determine for themselves when to take breaks and decide on work order, methods and speed of work. The reduced functional capacity with ageing may in part contribute to the finding that the lack of opportunity to 'self regulate' their work is a major factor in early retirement.

Responses to the OH&S survey indicated that the majority of the responding mines (77%) had no specific policies or procedures in place to accommodate older workers. In the minority of mines where these existed, they were reported as consisting primarily of job reassignment to less physically demanding jobs (83%), redesign of the job (33%) and reassignment of shift (17%). This appears to conflict with the data reported above, but it may be due to reassignment of workers to a different work category, rather than simple reallocation of duties. In any event, a general expectation is that miners are capable of undertaking most or all duties irrespective of age, an expectation that is not consistent with the evidence.

#### **4. Factors contributing to injury and fatigue**

It was also evident from the review that workforce demographics should be considered in the assessment and management of injury risk. The age profile indicates that serious efforts will be required to accommodate an older workforce in a physically demanding environment while at the same time maximizing their contribution in terms of skills and experience. Strain and sprain injuries are more common in older miners, at least in New South Wales (see Figure 4). Although the relationship between injury risk and increasing age generally is not conclusive, there seems to be agreement on the fact that when older workers are injured, the injury is more severe and recovery takes longer. For example, a recent study of about 50,000 workers in California confirms that older workers miss more days because of acute low back injury and tend to have longer periods of disability (Peek-Asa, 2004).



**Figure 4. Incidence rate of reported sprain and strain related injuries by age, 2001 (per 1000 employees) (NSW Coal Mining Industry)**

The types of accidents that disproportionately affect older workers include falls from heights or machines, slips and trips, and being struck by vehicles, machinery or falling objects. The reduced physical capacity of these individuals to keep their balance or to move out of the way of hazards is a major factor in such accidents. Similarly, in spite of increased mechanisation in mining many of the tasks still demand heavy physical work (Shepherd, 1999). This poses particular difficulties for older workers with reduced functional capacity and exposes them to increased risk of overexertion injuries and cumulative damage to the musculoskeletal system. Preventing such accidents or reducing their impact requires better understanding of the relationship between physical capacity and accident causation. For example, tasks that pose a specific hazard to older workers may be modified; focussed training and education programs can be implemented both for workers and managers; and, if individual risk factors could be reliably assessed, workers could be assigned appropriate safe duties on the basis of capacity, not age. Unfortunately, very little is known about the relationship between physical capacity and workplace accidents in older workers particularly in the mining industry.

Increasing the functional capacity of workers through complementary exercise programs is seen as a positive strategy to keep older workers working longer. Despite the relative lack of information about the older worker in coal-mining, there is a sound basis for paying special attention to health and fitness in the older age groups. This is not just out of concern for worker health in an altruistic sense. It is also an issue of cost and retention. For example, experience overseas has indicated not only that a heavy physical workload is associated with an increased risk of being retired on a disability pension (in a study of men aged between 42 and 60), but that this association was strongest that older workers with poor physical fitness (indexed by aerobic capacity). These retirements were caused not only by musculoskeletal injury, but all causes combined (Karpansalo, 2002).

The question remains however as to how much and what type of exercise is required to provide a protective function. Additionally, is it reasonable to expect older workers to participate in additional activity programs following tiring and often extended work periods? Other strategies that have been used overseas include more flexible work arrangements, job redesign (such as reducing tasks with high physical demand), and alteration of shift arrangements. The latter recognises the reduced tolerance to shift work, particularly night shifts, often experienced by older workers. It is also important that work ability can vary considerably not only across age but also among workers of the same age.

Both injury and fatigue are complex, multifactorial phenomena, in which the contribution of age, no less than the part played by other causal factors, is very difficult to determine. While conventional injury data-sets can be analysed by age, they do not establish that age *causes* the injuries, since exposure to hazard is generally not controlled. Perhaps for this reason, injury data are inconsistent with respect to age effects. While the ratings of OH&S personnel are clearly subjective, they also reflect a broader base of information than is included in accident statistics. It is therefore noteworthy that OH&S professionals in coal-mining did not rate age highly as an *independent* contributory factor to either injury or fatigue, but viewed a range of other specific factors as major contributors. For example, lack of fitness and skill, total exposure period and the work environment were seen as major contributory factors to injury, while type of shift, job type, work environment and boredom ranked highest for fatigue (Tables 1 & 2).

**Table 1. Ranking of factors contributing to work related injury at participating mines**

<b>Ranking</b>	<b>Contributors to work related injury</b>
Rank 1	Lack of fitness
Rank 2	Work environment
Rank 3	Total exposure period
Rank 4	Lack of skill
Rank 5	Lack of stamina
Rank 6	Mismatch between worker and job demands
Rank 7	Inadequate workload distribution
Rank 8	Insufficient training
Rank 9	Fatigue
Rank 10	Shift length
<b>Rank 11</b>	<b>Age</b>
Rank 12	Psychological stress

**Table 2. Ranking of factors contributing to work related fatigue at participating mines**

<b>Ranking</b>	<b>Contributors to work related fatigue</b>
Rank 1	Type of shift
Rank 2	Boredom
Rank 3	Job type
Rank 4	Work environment
Rank 5	Physical demands
Rank 6	Lack of fitness
Rank 7	Overtime
<b>Rank 8</b>	<b>Age</b>
Rank 9	Travel to/from work
Rank 10	Insufficient breaks
Rank 11	Psychological stress
Rank 12	Insufficient training

Thus, new strategies to retain workers are required, and these must be based on a greater understanding of the match between the workplace and the physiological and psychological changes characteristic of the older worker.

There are several other important avenues for addressing the needs of the older worker. One specific approach is to make it possible for older workers to modify their exposure to shiftwork, in part by allowing longer recovery periods, but also by progressively moving away from night shifts. There is strong evidence that older workers are more adversely affected by shiftwork than younger employees. (Härmä, 2001; Parkes, 2002).

### **Summary**

The largest continuous study of the influence of ageing on work ability was conducted in Finland at the National Institute of Occupational Health (Ilmarinen, 1999). The 11-year longitudinal study of

municipal workers emphasizes the importance of the interaction between working conditions, individual physical and psychosocial skills and lifestyle factors in the work ability of older workers. Social factors are difficult to influence but there is strong reason to spend useful time on improving work conditions, environment and work organization. Any interventions aimed at the individual or organizational level must be supported by evidence gained from rigorous scientific research. The Finnish study indicated that regardless of the occupation, improvement in work ability was most significantly influenced by increased satisfaction with supervisor, a reduction in repetitive and monotonous work and participation in increased physical activity. Information on conditions beneficial for retaining older workers is increasing and provides a large number of suggestions for practitioners working in these areas. What is needed in the mining industry is well conducted scientific investigations of a longitudinal nature which evaluate the efficacy of different interventions. These should take account of the specific cultural and environmental conditions operating within the mining industry.

We need more definitive information on:

- the numbers of older workers in the industry and the nature of the work in which they are involved;
- age related injury and adverse health patterns of older workers;
- the strategies being employed in the industry to manage the older worker with respect to changes in work organization, health surveillance, health promotion and training;
- reasons for older workers leaving the workforce, and
- a better understanding of the health and functional status of miners following retirement.

Cooperation between people of different ages will become a competitive factor in Australia and its enterprises, and it will be necessary to determine the appropriate blend of experience and 'youth', and identify the qualities of more experienced worker that must be retained for this cultural mix to impact positively on safety. To do this we need to understand the demographic trends in the mining industry and the level of potential imbalance in the workforce prior to establishing guidelines and rules to ensure cooperation between, and contributions of different ages. While the anti-discrimination and OH&S legislation has been helpful in reconciling any differences in the position of employers and unions to accommodate those with a disability, successful accommodation of the older worker will require the employers and unions to initiate change (Freeman, 2004). This should be considered on the basis of scientific evidence and within a structural framework which recognises the need for engagement of a range of experts able to develop innovative and cost effective approaches to job design and redesign, work organisation and work environment.

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