Working time arrangements in the Australian mining industry
Trends and implications with particular reference to occupational health and safety

Kathryn Heiler*
Richard Pickersgill*
Chris Briggs*

International Labour Office
Geneva
October 2000

*Australian Centre for Industrial Relations Research and Training, The University of Sydney

Foreword

The impetus for this study came from the realization that, notwithstanding the lack of comprehensive data on new working arrangements, the rate of change in working time in the mining industry was not being matched by changes in other related parameters at the workplace, including those affecting occupational safety and health. The effects of extended shifts on workers’ exposure to ambient factors, such as noise, dust, heat, vibration and chemical agents appear to be largely unknown or, if they are known, heavily under-reported. The attendant issues of fatigue and long distance commuting have health, safety and social implications that warrant further study; not to mention the impact of fatigue on productivity.

The first step in any process of analysis is to obtain reliable basic data. This was the purpose of this comprehensive survey of the Australian mining industry. The results and the subsequent discussion of implications for occupational health and safety comprise this working paper

A survey design and pilot study were funded by ILO. The project was subsequently further supported by ILO and by the Departments of Minerals and Energy in New South Wales and Queensland and the Joint Coal Board Occupational Health and Safety Trust. The ILO is most grateful for these three contributions. The resulting jointly-funded project throws new light on the extent of working time in Australian mines and on the variety of shift and roster arrangements that are used. It also emphasizes the importance of undertaking future work on the health, safety, industrial relations and social issues that are affected by working arrangements.

The relevance and importance of the issue to the industry is underlined by the exceptional response that was achieved. Ninety per cent of Australian mines with more than 20 employees were contacted and 93% of them (180 mines) provided information. This is a strong response from an industry that has often been very sensitive about the issue of shift arrangements.

The ILO hopes that this study will be the precursor to similar work in other countries and lead to a concerted attempt to ensure that any additional occupational risks or
hazards that are associated with extended working time and compressed shifts in mines will be identified and then eliminated or minimized without delay.

Oscar de Vries Reilingh  
Director  
Sectoral Activities Department

Introduction

This report collates and analyses data on shift work arrangements operating in Australian coal and metalliferous mines collected by a national telephone survey conducted in late January and early February 2000. It is supported by qualitative and desktop research undertaken both as part of this project and as a consequence of other contracted research in the Australian mining industry by the authors. The survey was funded by the International Labour Office as a pilot study and was further supported by the Minerals and Energy Departments of the New South Wales and Queensland governments, and by the Joint Coal Board Occupational Health and Safety Trust.

The survey and study were undertaken as a result of the apparently increased prevalence of compressed and extended shifts across all Australian industries and the difficulties, noted in Australian Bureau of Statistics’ publications, in collecting reliable data on the nature extent of these changes. Available information indicated that the mining industry was the sector in which major alterations to working time arrangements such as average weekly hours of work, shift length and roster patterns, was most apparent. The mining industry is also characterized by the presence of local and overseas transnational firms. Moreover, it is particularly sensitive to international commodity markets.

The primary driver for the study was the apparent uniqueness of Australian shift work arrangements and the lack of data on their social, economic and OHS implications. A secondary, but significant driver was an attempt to draw together the possible implications of these changing arrangements. This project raises important issues about the future impact of these working time arrangements on the mining industry in Australia. By inference there may be international implications.

Structure of the report

The report is divided into three sections

Section 1 contains the background to and context for the survey. This also includes a brief overview of the Australian mining industry – its place in the Australian economy, industrial relations/employment regulations and market trends – in order to put the trends into context and better understand them.

Section 2 presents the major findings from the national survey into shift work and rostering arrangement conducted in February 2000. The data are disaggregated by state, mining method and, as the Australian coal industry has some specific features, into "coal" and "non-coal" where appropriate.
Section 3 discusses the implications of these trends for working hours, occupational health and safety, family and community life, and industrial activity and trade unions.

Specific terms used in the report

Compressed shifts. Where an average of around 40 hours per week is worked in fewer days across a roster cycle. In this case time worked and time off are roughly symmetrical. For example, a typical compressed schedule may consist of four 12-hour shifts followed by four days off with an average of approximately 42 hours per week over a four week cycle. This means that over a 28 day cycle 16 days are worked instead of 20 under a typical eight hour roster. In some cases the compression cycle is longer (14 days worked followed by 7 days off) – typical of long distance commuting sites.

Extended shifts. Where time worked and time off are not symmetrical and more shifts are worked than are allocated in time off. In this case, instead of compressing the hours worked into fewer days, both longer days and longer average weeks are worked without being offset by time off. For example, instead of working 16 12-hour shifts over a 28 day cycle, employees may either extend individual shifts with overtime and/or work additional shifts.

Intensive schedule. A combination of long shifts (12 or more) combined with long overall weekly hours.

As the Commonwealth of Australia is a federation of states and territories the terms "Federal" and "Commonwealth" with respect to the national government are used interchangeably in the text.

1. Background and context

1.1 The Australian mining industry

The mining industry occupies an important position in the Australian economy. In 1996-97, the mining industry accounted for $22.6 billion (AUD) or 5% of Australia’s GDP. Over the last three decades the Australian mining industry has become one of the world’s largest with high levels of foreign investment. It is the nation’s leading individual export earning sector.

In 1997-98 Australia exported $9.6 billion worth of black coal (representing 11% of total merchandise exports), $6.3 billion of gold (7% of total merchandise exports), $3.8 billion of iron ore (4.3% of total merchandise exports) and $3.3 billion of bauxite/alumina (3.7% of total merchandise exports) (ABS, 2000). Its role in wealth generation and linkages with other key industries such as electricity generation, steel and transport make the mining industry an integral, powerful component of the Australian political economy.

Employment
Total employment in the mining industry at June 1997 was 55,713 (ABS, 2000: 477-79). Output growth has vastly outstripped employment growth, reflecting strong increases in capital and labour productivity. In coalmining, for instance, output has more than doubled since 1980 but employment has declined by just over a quarter from its peak in 1986 to 23,800 in December 1997 (Productivity Commission, 1999: 39 & 65). Large-scale retrenchments and restructuring of the industry occurred during the 1990s (Maher, 2000). The workforce is overwhelmingly male and older than the Australian average. This is more pronounced in the coal industry than in the metalliferous sector (ACIRRT, 1998). Although the direct employment generated by the mining industry is a relatively small part of the Australian labour market, it is a very important source of both direct and secondary employment in regional areas of the main mining states of Western Australia, Queensland and New South Wales.

**Unionization**

The mining industry in Australia is still strongly unionized, but there are important differences between the metalliferous and coal sectors. Although the coal industry in New South Wales is still strongly unionized, the metalliferous sectors in Western Australia and, to a lesser extent, in Queensland have experienced declining levels of unionization.

There are also differences in trade union coverage and culture between the sectors. In metalliferous mining, the principal union is the Australian Workers’ Union (AWU), whereas the principal union in coal mining is the industrially powerful Mining Division of the Construction, Forestry and Mining Employees’ Union (CFMEU). This Division of the CFMEU, formerly known as the United Mine Workers Federation, is generally considered as more interventionist and socially active than the AWU. Other important unions in the mining industry are the Communication, Electrical and Plumbing Union (representing the small but strategically important electrical trades) and the Australian Manufacturing Workers’ Union (AMWU), representing engineering and mechanical trades. The CFMEU sometimes competes with the latter two unions for coverage of skilled-trade level workers.

In general, coal mining unions have established higher rates of pay and "job control" through extensive informal regulation, custom and industrial practice, than those in metalliferous mining (Hawke & Robertson 1999: 35; Wooden, et al. 1996).

**Market pressure**

The Australian mining industry, particularly the coal sector, has come under significant pressure during the 1990s. This is primarily due to the emergence of low-cost suppliers in Asia, such as Indonesia, increased competition in international markets and resultant pressures from domestic employers to restructure the industry and reduce costs associated with their operations. In addition, despite projections of continued growth in global demand, there has been a downward trend in international prices that is expected to continue. In black coal, for example, global demand is projected to grow by 2% per annum between 1997-98 and 2009-10 but real prices are projected to decrease by more than 2% per annum. Lower prices and competitive pressures have led to a squeeze on profit margins (Minerals Council of Australia 1999; Productivity Commission 1999; 41-42) and these tougher economic conditions
have, in turn, placed pressure on regulatory arrangements and wage and employment conditions in the mining industry.

This has seen pressure by employers to extract optimum flexibility under pre-existing sector-wide industrial award arrangements and now to seek to maximize site and firm level deliberation of wages and conditions across the industry under new and emerging workplace level bargaining arrangements.

1.2 The Australian industrial relations regulatory framework

Historical role of "industrial awards"

The primary source of employment regulation in Australia for most of this century has been the "awards" of federal and state industrial tribunals. Section 51 (xxxv) of the Australian Constitution gave power to the Commonwealth Government to legislate for "conciliation and arbitration for the prevention and settlement of industrial disputes extending beyond the limits of any one state" (Creighton & Stewart 1994: 56). As a consequence, and drawing on Australian and New Zealand colonial precedents, the Federation of the Australian colonies in 1901 saw the new Commonwealth Government commence to establish, at national level, the uniquely antipodean system of conciliation and arbitration tribunals. Similar tribunals operate at state level. These tribunals were delegated the authority to settle industrial disputes through adjudications placed in legally binding documents called "awards", usually covering an occupation or industry.

The direction of recent industrial relations change

Australian industrial relations have undergone significant change over the last two decades, with the intensity of change escalating since the early 1990s. Not only have state and federal governments introduced changes to increase the type and range of bargaining processes and instruments, but profound labour market and industry changes have also underpinned a level of economic and workplace restructuring, the effects of which continue to reverberate across Australian society.

Although they remain an important source of industrial regulation, awards have been simplified and placed in the shadow of enterprise and individualized bargaining during the 1990s as part of a drive by policy-makers to encourage agreement-making and "workplace flexibility" (Gardner & Ronfeldt, 1996). Commencing in the late 1980s and early 1990s under a federal Labor Party administration, enterprise flexibility/award modernization clauses were placed in federal awards to allow enterprise-level variations of standard award provisions, including working hours. The Industrial Relations Legislation Amendment Act 1992 and the Industrial Relations Reform Act 1993 aimed "to ensure certified agreements are available as a real alternative to the award system and not reserved for exceptional circumstances" (Peter Cook, Federal Minister for Industrial Relations, cited by Hancock & Rawson, 1993).

For the first time, and under a Labor administration, provision was made for registering collective agreements to which unions were not a party. The new role of
the tribunals was to facilitate enterprise agreements and maintain awards as a safety net underpinning enterprise bargaining.

The Workplace Relations Act (1996) introduced by the new conservative coalition Government which took office in 1996 built upon the foundations of this legislation by requiring awards to be simplified to just 20 allowable matters and further limited the powers of the tribunals. The original Bill (modelled on earlier New Zealand legislation) explicitly intended to replace collective arrangements with individual contracts. Although this intention was rejected by the Senate (the Australian upper house) and the Bill itself was substantially modified, the centrepiece of the new legislation was the provision to allow the registration of individual agreements that would over-ride awards. These are known as Australian Workplace Agreements (AWAs).

This legislation has seen a shift from an historical reliance on the industrial powers of the Constitution towards a reliance on the corporation powers. This has led to a re-emphasis on contract law applied to employment relations and has been accompanied by a range of regulations intended to inhibit collective action and, where possible, to encourage the individualization of the employment relationship. Over the same period, all state jurisdictions also introduced legislative changes to encourage enterprise rather than sectoral bargaining. Some states, for example Western Australia, have gone much further than others, such as New South Wales in promoting individual bargaining and the stripping or simplification of award conditions.

This labour market re-regulation, from national and sector level to enterprise and individual level, has had two primary aims. First, to move employees out of award regulation and into different bargaining streams (non-union collective, union collective and individual) and second, to restructure the residual award stream and restrict both the reach and range of issues with which it can deal (Campbell and Brosnan, 1997). This has allowed increased bargaining over a range of issues, including working hours, that were once determined within industry-wide and even community-wide frameworks. A secondary effect has, arguably, been the increased de-collectivization, individualization and resulting fragmentation of both wage and conditions outcomes (Heiler, Arsovskta and Hall, 2000).

Where the primary regulatory framework governing the determination of wages and conditions (including hours) was formerly found in industrial awards, workplace relations, wages and conditions are now increasingly regulated under a combination of five different instruments:

- Federal and state legislation (industrial relations, occupational health and safety and anti-discrimination, corporation and contract law);
- The industrial awards of federal and state industrial tribunals;
- Enterprise agreements (union and non-union);
- Individual agreements (state and federal under industrial law);
The (individual) employment contract (under contract and common law).

### Occupational health and safety

The relative importance, relationship and impact of these regulatory instruments have changed dramatically over the past decade. Federal and state legislation establishes the framework of rights and responsibilities for employers, unions and employees and minimum standards in some areas such as wages, some conditions, occupational health and safety and leave arrangements.

The importance of mining for economic development and the specific nature of the hazards associated with underground mining in particular had also resulted in some industry-specific legislation such as the former Coal Mining Act, 1925 (Queensland) and the Coal Mines Regulation Act, 1982 (New South Wales). These statutes focused primarily on the regulation of occupational health and safety in the coalmining industry. Even this legislation, however, is undergoing change as coal mines move away from prescriptive legislation and come under a more general duty of care obligation such as those introduced in Queensland under the Queensland Coal Mining Safety and Health Act (1999), which will come into force in September 2000 and some changes mooted in the NSW legislation covering coal, metalliferous and extractive industries. As will be noted later, the changes in this legislation will, for the first time, target the specific effects of working time arrangements in the form of requirements to pro-actively manage the effects of fatigue at a workplace level.

### Industrial relations in mining

In mining, the bulk of employment regulations were determined by a combination of parent industry awards (e.g. the Coal Mining Industry (Production and Engineering) Consolidated Award 1997), occupational awards and secondary awards (which mostly follow the parent award) supplemented by site level over-award bargaining and informal regulations determined through custom and practice.

In fact, the mining industry, and especially the coal industry, has long been characterized by active workplace level bargaining. Local union lodges have always had considerable autonomy to develop and implement local arrangements that were usually, and significantly, above the award. However, there have also been sectoral differences in wage and working conditions outcomes between the coal and metalliferous sectors, with the coalmining sector, by and large, enjoying superior wages and conditions compared with the metalliferous sector. Historically this has largely been the result of a fluctuating combination of national and international commodity prices and local industrial bargaining power.

Over the past decade, however, the influence and impact of changes to industrial relations law have also emerged as significant drivers for change in the coal industry. The situation at the current time is still volatile. There is considerable bargaining over aspects of work organization (such as hours and shift work arrangements) that were previously viewed as heartland control issues for the union, but which have been undergoing sustained regulatory change. Indeed, one of the key areas of activity in
mining agreements (as is also the case in other industries) has been to alter hours of work provisions and, in particular, to free up shift work arrangements (Heiler, 1998). This bargaining activity around hours of work has to be set against the context of weak industry or community-wide accepted standards about what constitutes safe or acceptable working time arrangements. Indeed, assumptions that working time standards contained within industrial awards would be preserved, despite increased and active bargaining, have proven to be, arguably, incorrect.

1.3 The regulation of working time

The regulation of working time in Australia has traditionally been undertaken almost entirely through the award system. Unlike many other OECD countries, Australia has no community-wide, legislative limitations on maximum hours of work, shift work or the length of the working day. Historically this was not seen as problematic since compliance with industry-wide award standards, and some state legislation which specified some isolated minimum standards, whilst not always consistent, did act as a de facto enforceable set of industrial standards governing working hours. Indeed, it was a model that, until the late 1980s and early 1990s, was reasonably successful in standardizing hours of work across and within industries.

At the beginning of the 1990s, the standard working time model codified in awards was for 35 – 40 ordinary hours per week, usually worked as an 8-hour day, with provision for any overtime to be paid at a penalty rate. Many industries also operated a 19-day month with one rostered day off (RDO) per month. Most awards contained detailed provisions associated with payment or compensation for additional hours (overtime) and non-standard hours (including shift work). Awards usually also contained provisions in relation to:

- The number and spread of ordinary working hours in each day;
- The number of ordinary hours per week (or sometimes a longer period such as a fortnight or month); and
- Special rates for work performed outside these hours (e.g. overtime, shift loadings, penalty rates).

Formerly, state and federal industrial tribunals had not been predisposed to expand the codification of "unusual" or extended working hours unless there were exceptional and compelling industry circumstances. Where shift work was permitted, such as in the manufacturing sector, the mining industry and emergency services requiring 24-hour operation, the award would usually define in detail the types of shift (starting/finishing times of an afternoon shift or night shift) and the maximum length of the shift. It would also set out details governing overtime rates and hours and provide for the same number of ordinary hours as in ‘standard’ working time arrangements. There would also be some form of additional compensation for shift work usually by way of shift "loadings" that explicitly compensated for the personal and social costs that were deemed to be a result of non-standard hours. In other words, both in terms of the average length of the working week of around 40 hours and the structure of
compensation that surrounded irregular and non-standard hours, well over 60% of the workforce, up until the late 1970s, appeared to fit within this standard profile of arrangements.

Over the past decade, however, the trend in Australia appears to have been to move away from this historically standardized working time model towards an increasingly fragmented and diversified one. In particular there has been a "hollowing-out" of the pattern of distribution and an increase in employees working either very long hours (in excess of 49 per week) and those working less than full-time hours. Average hours for full-time employees are now around 44 per week, an increase of about three hours per week in just eight years and a seeming 'structural shift towards longer full-time hours across all industry groupings.

Figure 1.1 shows the decline in standard hours for full-time workers from 1978 to 1997. It reveals that less then 50% of full-time employees now work 40 hours or less per week, and that the most significant increase has been among full-time employees working very long hours of 49 or more per week.

**Figure 1.1 Change in hours of work: full-time employees in Australia 1978-97**

This increase in average hours for full-time employees has been accompanied by a change in the distribution of hours, with the hollowing-out of standard hours across
the labour market we referred to before clearly shown in figures 1.2 and 1.3 below. This hollowing has meant that large proportions of employees are clustered at one extreme or the other; either working far less than around 35 hours per week, or well in excess of 49 hours per week. There also appears to be a strong gender component to this trend, with males clustering around longer full-time hours and women clustering in part-time hours.

This shift in the distribution of hours in Australia appears to be most strongly associated with structural changes in the labour market. These include changes such as the high growth of part-time and casual employment, the workplace level restructuring that has seen significant employment reduction and an associated increase in work intensification and an increase in operating hours of organizations and companies which require more flexible and non-standard forms of labour (ACIRRT, 1999). This move away from standard hours of work (where the majority of the workforce worked 35-40 hours per week) has been most pronounced among males, but has also been significant among women. These trends are shown in Figures 1.2 - 1.4.

**Figure 1.2 Change in the distribution of working hours in Australia, 1983–98: all employees**

![Chart showing distribution of working hours]

*Source: ABS: Labour Force Australia; Cat. no. 6203.0, August issues.*

Figure 1.3 shows that these shifts in distribution are most pronounced for males. By 1998, for instance, 43% of all male employees were working in excess of 40 hours per week and almost one third (27.3%) were working over 49 hours per week.
Figure 1.3 Change in the distribution of working hours in Australia, 1983-98: Males

This can be contrasted with trends for women. There was a sharp drop in the proportion working 40 hours per week in 1983 (from 23% to 12.5%) and a continuing increase in those working less than 30 hours per week.

Figure 1.4 Change in the distribution of working hours in Australia, 1983-98: Females
Overall, the trend in hours of work since the late 1970s and especially the early 1980s has been one of steadily increasing hours for full-timers. At the same time there has been a hollowing-out of traditional standard hours across the labour market, most pronounced for males. These broad aggregate trends provide the context for understanding what has happened to average hours of work within the Australian mining industry.

**Working hours in the mining industry**

As with other industries, the mining industry has experienced a significant increase in average weekly working hours since the early 1980s. However, the mining industry has not experienced the same hollowing-out and fragmentation in hours seen in most other industries, since the overwhelmingly form of employment in the industry is full-time. Instead, we have seen full-time hours steadily increase to the point where the mining industry has the longest hours profile of any industry in Australia. A number of different data sources illustrate these changes.

The increase in average weekly working hours across the industry has been steady since at least the early 1980s, when average hours across the industry were around 46 per week in 1983. By 1997, average hours had increased to 51.7 per week, longer than in any other industry. These trends are shown in figure 1.5. Not only does mining have the longest hours, it has also experienced the greatest increase in hours, accelerating between 1993 and 1997. Across the mining industry in 1997 the hours (51.7) consisted almost an extra full day (over seven hours) more than the all industry average (44.3).

**Figure 1.5 Changes in average hours of work: full-time employees**

However, these average increases mask a more complex sectoral distributional difference within the industry. Census data presented in Table 1.1 below shows that while both coal and metalliferous hours increased between 1991 and 1996, the proportion of persons working in excess of 41 per week in the metalliferous sector increased from 51.9% to 65.3% (13.4%), while in coal this proportion increased from 42.7% to 52.4% (9.7%).

Table 1.1 Hours of work in the mining industry, 1991 and 1996

<table>
<thead>
<tr>
<th>Industry</th>
<th>Metal Ore Mining</th>
<th>Coal Mining</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1991 Census (%)</td>
<td>1996 Census (%)</td>
</tr>
<tr>
<td>Hours</td>
<td>3.0</td>
<td>2.9</td>
</tr>
<tr>
<td>1-24</td>
<td>2.3</td>
<td>1.5</td>
</tr>
<tr>
<td>25-34</td>
<td>42.7</td>
<td>24.5</td>
</tr>
<tr>
<td>35-40</td>
<td>51.9</td>
<td>65.3</td>
</tr>
</tbody>
</table>


The longer hours worked in the metalliferous sector illustrated by these aggregate trends were confirmed by our survey data outlined in Section 2 below. The results showed that, across the industry as a whole, over 70% of all employees worked in excess of 41 hours per week. In the metalliferous sector this figure was over 85% compared to around 50% of coal employees. This figure is even more stark when we compare the proportion of employees who work in excess of 49 hours per week. In coal this figure is around 4.2% while in metalliferous, more than 60% of employees work in excess of 49 hours per week. Thus we can see that whilst the mining industry as a whole has a very long hours regime, the metalliferous sector was primarily responsible in large part for these very long hours.

As a point of interest, the increase in hours of work across the Australian mining industry was also highlighted in international data contained in the *ILO Yearbook of labour statistics* that compared changes in hours between 1988 and 1997. Although average hours worked across countries are not necessarily directly comparable, the direction of increase is reliable. ILO data shows that while some countries appeared to experience a decline in average hours worked, Australia was one of the countries, along with the US, UK, Canada and Republic of Korea, that recorded a significant increase over this period.
Trends in shift length

Aggregate data on the extent, nature and detail of shift work arrangements across the Australian labour market have not been particularly robust. Part of the reason for this is that information about shift work arrangements and rosters is complex and difficult to collect; any one workplace may have several different roster systems and structures. The roster pattern can be stable or rotational and can be structured across a week or several months. We suspect that around 17% of all employees in Australia work some kind of shift arrangement (ABS, 1997), but the reliability of this figure can also be questioned. The reason is that the definition used for a shiftworker no longer reflects the large number of workers who now work outside of standard hours, many of whom may not identify as shiftworkers. Changes in the ordinary span of hours, increased operating of businesses, removal of loading and shift penalties, the annualization of hours and salaries all potentially place employees in situations where they can be called upon to commence work prior to 6am and finish work well after midnight (the traditional definition of a shiftworker). Traditionally the employees would have been classified as shiftworkers but the likelihood of them (information workers, service workers) labelling themselves as shiftworkers is lower than in traditional shift work areas (Heiler, 1998). In addition, traditional sources of data collected information about the details of the shift arrangements, especially with respect to shift length. This is partially because assumptions were made that shift length was stable at around 8 hours of ordinary time. It has taken some time for the data collection to catch up with the changes at a workplace level. The Australian Workplace Industrial Relations Survey (1995) did collect some limited information on shift length. This is useful to compare with the trends we detected in our survey. The
AWIRS showed that in 1995, just over 10% of Australian workplaces had some or all employees who worked 12-hour shifts. While not precise, we can calculate from this data that in 1995 around one-third of mining workplaces had some or all of their employees working 12-hour shifts, with most of these in the non-coal sector (AWIRS 1995, unpublished data). This compares with the findings of our survey which revealed that over 50% of all mine sites nationally by 2000, and well over 70% in the metalliferous sector, worked 12-hour shifts. While not exact, we can detect a significant increase over this five year period.

In addition, we have seen that aggregate trends reveal both an increase in shift length and an increase in average weekly hours. Thus increasing sectors of the industry are working long daily hours combined with long weekly hours. In other words, the combination of our survey data and the aggregate hours data shows that the mining industry deviates from other industries in that a large proportion of the workforce are working not just long daily hours but long weekly hours as well. This means that the promise of compressed shift arrangements – of working fewer days and controlling hours within a standard range – is, by and large, not being delivered in the mining industry, and particularly in the metalliferous sector. The emergence of these intensive work schedules (QMC, 2000) can be briefly speculated upon.

**Hours of work and decentralized bargaining?**

Hours of work are now the subject of considerable bargaining at a workplace level across all industries, with both employers and employees seeking a level of flexibility that meets what each side asserts as its specific needs. While interest in changing hours of work commenced in the 1980s, the focus on hours of work changes has been a central feature of both collective and individual agreements. Indeed, changes to hours of work provisions have been among the most common provisions in agreements across all bargaining streams since the early 1990s (ACIRRT, 2000). Figure 1.7 below shows that hours of work flexibility provisions are found in over 80% of enterprise level agreements, second only to provisions related to grievance procedures. This is true irrespective of the bargaining stream. Figure 1.7 shows the most common provisions in union and non-union collective agreements and individual workplace agreements (AWAs).

**Figure 1.7 Common provisions in collective and individual agreements**
However, the extent to which these new forms of flexible working time arrangements genuinely benefit employees and the degree to which decentralized bargaining may be driving longer hours has been the subject of considerable debate and counterclaim (e.g. Buchanan and Bearfield, 1997; Campbell, 1997; Heiler, Arsovska and Hall, 2000; Wooden, 2000). While there is not necessarily a direct causal link between decentralized and individualized bargaining, there does appear to be a relationship between the kinds of provisions appearing in agreements, as is shown in Figure 1.8 below. Moreover, Wooden found in his analysis of the relationship between longer hours and form of bargaining that the high incidence of long hours at workplaces was most strongly related to the workplaces where individual contracts were in place (Wooden, 2000). Figure 1.8 shows how certain kinds of provisions in agreements are more likely to appear in non-union and individual agreements than in union agreements. These provisions are the ones most likely to be associated with changing or reducing compensation for longer or non-standard hours of work. These agreements include provisions such as increasing the ordinary days of the week and ordinary hours of the day which do not attract additional compensation, reducing overtime rates or time off in lieu provisions. While we may not be in a position to state categorically that there is a causal relationship between bargaining arrangements and trends in working hours, there is a relationship beginning to emerge.

Figure 1.8 Hours provisions in registered collective and individual agreements
What is becoming clear, however, is that the historical reliance on the award system, and the rapidity of working time changes have exposed an effective regulatory vacuum around working hours in Australia that is arguably leading to a level of unprecedented and unanticipated fragmentation and dispersion (Heiler, 1998a). As provisions in enterprise and individual agreements move away from the standards and structures contained within industry awards, they move also into uncharted and effectively unregulated waters where agreement about standards is generally absent. The emergence of new forms of bargaining-union, non-union and individual-has placed pressure on the traditional structures contained within awards for managing and setting the parameters for working time arrangements. These pressures exist strongly within the mining industry in Australia.

**Developments in the mining industry**

Mining industry employers have been at the forefront of moves to shift from awards to enterprise bargaining; especially from collective forms of employment regulation to individual agreements. This has occurred in a widespread way in the metalliferous sector, particularly in Western Australia where the Australian Workers’ Union has coverage. It has, however, met with greater resistance in the coal industry where the CFMEU (Mining Division) has primary coverage.
Until the late 1990s most enterprise agreements in the coal industry (as a result of a strong union bargaining position) did not entirely replace the award. Agreements generally contained few provisions that comprehensively dealt with issues traditionally covered by the award. A study of 27 coal industry agreements undertaken by ACIRRT in February 1997 showed that 70% of them contained provisions to modify shift arrangements in some way (ACIRRT, 1997). However, the majority of them did not contain provisions that dramatically lengthened shifts or reduced compensation for shift work.

These early agreements focused on increasing the ability to swap shifts, on variations to shift rates and on specifying the nature of the shifts (i.e.; fixed or rotating). Twelve-hour shifts had made an appearance in agreements by this time, with five of the 27 agreements analysed providing for these shifts. Significantly, one of these mines was the Vickery Mine at Gunnedah in NSW, owned by Coal and Allied (now Rio Tinto), where the introduction of these shifts became part of a bitter 12 month dispute. By and large, until the late 1990s in the coal industry, decentralized bargaining was occurring but was underpinned by a comprehensive award that protected basic conditions. The process of award simplification and declining union bargaining power in recent years suggests that more profound and structural changes are taking place.

As recently as June of this year, the Australian Industrial Relations Commission (AIRC) rejected a number of appeals by the CFMEU over the award simplification process that allowed employers unilaterally to extend ordinary hours of work. Foremost among the employers’ claims before the Commission was the "right" of employees to agree to longer hours or longer shifts. The AIRC determined that, in the interests of efficiency and productivity, "restrictions in the allocation of work" would be removed and the right of employers to impose 10-hour shifts without agreement, and to make application for 12-hour shifts would be upheld (Workforce, 2000). The Commission argued that these changes in working time arrangements were needed to "reduce labour costs and boost productivity" (Maher, 2000). In July of this year, after a long running and at times bitter dispute in the Hunter Valley at the Mount Thorley Mine with Coal and Allied (Rio Tinto), the CFMEU reluctantly signed off on an agreement that allowed management to determine start and finish times without negotiation, to introduce 12-hour shifts with a "hot-seat" changeover and to allocate additional overtime as required. Coal and Allied’s Managing Director stated that: "It gives us everything we have been seeking by way of flexibility, productivity and management control" (Long, 2000).

The move to individual employment contracts has been most successful in the metalliferous sector in Western Australia, accentuated by a high level of contract employment across the industry. Inroads are continuing to be made in the coal industry but the rate of growth has been far slower. From the early to mid-1990s, particular transnational mining corporations operating at multiple sites embarked on a drive to lessen the role of third parties by offering large pay increases conditional on the acceptance of increased flexibility and, in some instances, individual contracts and/or reclassification to staff positions. Major disputes have flared periodically, either at the instigation of unions trying to check the spread of individual employment contracts (e.g. Weipa [1995]) or at the instigation of managers, some of whom it has been claimed, view:
"strikes and lockouts as golden opportunities through which to initiate change processes" (Bowden & Russell 1998: 8).

The passage of the Workplace Relations Act (1996) and the introduction of AWAs:

"...provided coal owners with a strategic opportunity to by-pass established awards, custom and practices, trade unions and collective bargaining entirely" (Bowden and Russell, 1998: 7).

Changes to longstanding working time arrangements have been an integral part of these new arrangements across all industries. In general, it has been assumed that what is flexible and efficient for business is also, virtually by definition, progressive for employees. This has particularly been the case with respect to the emergence of non-standard compressed and extended working time arrangements such as those within the mining industry.

It is to an examination of these merging trends that we now turn.

2. Results of the survey of the Australian mining industry (February 2000)

2.1 Methodology

The population for the survey was all operational coal and metalliferous mines of more than 20 employees. Preparation and processing plants in mining and quarrying operations were excluded for cost reasons. The survey frame was drawn from the 1999 Australian general mining year book and the 1999 Australian coal year book (AMS, 1999). All mines in these yearbooks with more than 20 employees and classed as operational were included. The primary unit of analysis was the mine site, rather than individual employees. Information on the roster that most employees usually worked in production and maintenance at that site was collected. This was to enable the most common arrangements for the majority of employees to be determined. This approach was adopted, rather than attempting to describe all site rosters, since there are a vast number of possible individual rosters, although only a small number of employees might work any particular roster.

The protocol was developed by the researchers and it was administered by a commercial survey company. An initial telephone screening was conducted to eliminate non-operational mines and to confirm contact details. The senior person with knowledge of shift roster arrangements was identified. A total of 217 mines were identified and 180 useable surveys completed. There were 13 refusals, seven confirmed as closed and a further 14 that could not be contacted. Excluding closures, this represented an overall response rate of 86%. From the 196 mines able to be contacted, a 93% response rate was secured. This meant that overall there was a 7% refusal rate. This can be interpreted as a very strong response from an industry that has been highly sensitive about the issue of shift arrangements.
2.2 Types and distribution of mining activities

Mining activities are unevenly distributed across Australia. As table 2.1 below shows, the majority of mines responding to the survey were in three states, Western Australia (32%), New South Wales (31%) and Queensland (23%). These three states

Table 2.1 Distribution of responding mines by state (in order of number of mines)

<table>
<thead>
<tr>
<th>State</th>
<th>Frequency</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA</td>
<td>57</td>
<td>31.7</td>
</tr>
<tr>
<td>NSW</td>
<td>55</td>
<td>30.6</td>
</tr>
<tr>
<td>Qld.</td>
<td>41</td>
<td>22.8</td>
</tr>
<tr>
<td>NT</td>
<td>9</td>
<td>5.0</td>
</tr>
<tr>
<td>VIC</td>
<td>8</td>
<td>4.4</td>
</tr>
<tr>
<td>TAS</td>
<td>7</td>
<td>3.9</td>
</tr>
<tr>
<td>SA</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
</tr>
</tbody>
</table>


When grouped into main commodity types, the results show that black coal (40%) and gold mining (29%) provide the largest proportion of sites (69% of respondents; table 2.2 below).

Table 2.2 Major products produced by mines (all respondents)

<table>
<thead>
<tr>
<th>Product</th>
<th>Frequency</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black coal</td>
<td>71</td>
<td>39.4</td>
</tr>
<tr>
<td>Brown coal</td>
<td>6</td>
<td>3.3</td>
</tr>
<tr>
<td>Gold</td>
<td>52</td>
<td>28.9</td>
</tr>
<tr>
<td>Zinc</td>
<td>9</td>
<td>5.0</td>
</tr>
<tr>
<td>Iron ore</td>
<td>10</td>
<td>5.6</td>
</tr>
<tr>
<td>Copper</td>
<td>12</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>Qld.</td>
<td>NSW</td>
</tr>
<tr>
<td>----------------</td>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>Open Cut</td>
<td>62.5</td>
<td>34.5</td>
</tr>
<tr>
<td>U/ground</td>
<td>30.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Both</td>
<td>7.5</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Source: ACIRRT ILO Survey, February 2000 (Population, all mines, n=180 responses)

Coal, which represents the greatest number of sites, is almost exclusively concentrated on the eastern seaboard, with Queensland and New South Wales together containing 90% of all coal mines.

**Open cut and underground operations**

Overall, open cut operations are the most common (49%), followed by underground (40%) and mixed operations 11% (table 2.3).

Of the three major mining states (WA, NSW, Qld.), New South Wales is the only state to have a higher proportion of underground mining. This reflects the high proportion of underground coal mines in NSW. Overall, Queensland is more broadly comparable to Western Australia in its mixture of mining operations than it is to New South Wales, despite the high proportion of coal mines in the two eastern seaboard states.

### 2.3 Operational days, hours and community setting
The time of operation gives a good indication of potential rostering arrangements. As mines move towards continuous operation it appears the incentive is greater to move towards compressed arrangements (12-hour shifts), particularly if sites are remote or isolated.

**Days of operation**

The survey results show that there are significant differences between the coal and metalliferous sectors and among the three major mining states. As can be seen in figure 2.1, 70% of all Australian mines operate on a seven day a week basis, with Western Australian mines most likely to operate on a continuous basis (93%). Queensland is just above the national average at 75% with New South Wales far less likely at 38%. The greater percentage of seven-day operations in Western Australia is not purely a function of remoteness or isolation, since almost one-third of these mines are in settled, mixed communities. Coalmines are also far less likely to operate on a continuous seven day per week basis than are non-coal mines.

![Figure 2.1 Days of operation: Seven day operations and others](image)

Derived from: ACIRRT ILO Survey, February 2000. (‘all mines’ n=180); (‘coal’ n=77); (‘non-coal’ n=103) (‘Qld.’ n=41) (‘NSW’ n=55) (‘WA’ n=57).

**Hours of operation**

The difference between the states and sectors for days of operation is sustained for daily hours of operation, although to a lesser degree. Overall, 86% of mines operate on a 24-hour basis. Of those mines not working on a 7-day/24-hour basis, the largest proportion are in the coal industry, where 53% of mines work less than seven days a week and 21% work less than a twenty four hour day (figure 2.2 below).
Western Australia again stands out as the most likely state for mines to operate 24 hours per day, while Queensland conforms to the national average. Interestingly, while only around 38% of New South Wales mines operate for seven days per week, double this number operate 24 hours a day. \textit{This suggests that daily continuous daily operation does not necessarily imply seven days per week operation, (at least in New South Wales), whereas it is the general rule in Western Australia and Queensland.}

Figure 2.2 Operating hours of mines: 24 hour operations and others

![Pie chart showing operating hours of mines](image)

Source: as above.

Community setting

The community setting of the mine was also significant for type and times of operations. Overall, 62% of mines are located in a settled mixed community, with 16% in relatively isolated mining towns and a further 22% operating on a "fly-in/fly-out" basis. As figure 2.3 shows, the tendency is for coal mines to be in a community setting; a large proportion of Western Australian mines to be ‘fly-in/fly-out’ operations; and the location of New South Wales mines to be in a community setting. In Queensland the majority of sites (56%) are located in a mixed community setting with 23% in isolated communities. Western Australia and Queensland, the two largest states in area, have the most long distance commuting sites; with Western Australia (49%) and Queensland (21%) using fly-in/fly-out operations. The Northern Territory, large and sparsely populated like Western Australia, has six out of its nine mines operating as open-cut operations, with the largest mines, also fly-in/fly-out, operated from isolated mining towns.

Figure 2.3 Community setting of mines
Not surprisingly there appears to be a relationship between mine location and mine operating hours. Table 2.4 below indicates that almost all mines operating for less than seven days per week (48 of 49, col.1) and all those operating less than 24 hours per day (column 3) are within settled/mixed communities. In Queensland, only one mine operates less than seven days per week and less than 24 hours a day (coal), while only three mines operate less than 24 hours a day. All four are within a settled community, with the three mines operating less than 24 hours a day also operating with 12-hour shifts.

Table 2.4 Times of operation by community setting (number of mines)

<table>
<thead>
<tr>
<th></th>
<th>Less than 7 days per week</th>
<th>7 day operations</th>
<th>Totals</th>
<th>Less than 24 hours per day</th>
<th>24 hours per day</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Community</td>
<td>48</td>
<td>55</td>
<td>103</td>
<td>24</td>
<td>79</td>
<td>103</td>
</tr>
<tr>
<td>Relatively Isolated</td>
<td>1</td>
<td>24</td>
<td>25</td>
<td>-</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Fly-in/Fly-out</td>
<td>-</td>
<td>38</td>
<td>38</td>
<td>-</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>117</td>
<td>166</td>
<td>24</td>
<td>142</td>
<td>166</td>
</tr>
</tbody>
</table>


2.4 Shift length and roster patterns
The potential complexity and multiplicity of rostering arrangements meant that the survey focused on collecting descriptive data about the main rosters at each site surveyed. Sites were asked to specify standard shift length, rotation pattern, number of consecutive minimum and maximum shifts, ordinary average hours of work and overtime practices.

**The length of "standard" shifts**

Respondents were asked to provide identical information about both production employees and maintenance employees. As table 2.5 indicates, there is a high proportion of 12-hour shifts in mining. There are also some differences between production employees and maintenance employees, with maintenance workers less likely to work 12-hour shifts.

**Table 2.5 Standard shift lengths for production and maintenance employees: all respondents all mines (per cent)**

<table>
<thead>
<tr>
<th>Standard shift length (hours)</th>
<th>Production employees</th>
<th>Maintenance employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 or less</td>
<td>23.5</td>
<td>28.9</td>
</tr>
<tr>
<td>8 - 10</td>
<td>10.5</td>
<td>12.1</td>
</tr>
<tr>
<td>10 - 12</td>
<td>12.4</td>
<td>14.1</td>
</tr>
<tr>
<td>12 or more</td>
<td>53.6</td>
<td>45.0</td>
</tr>
</tbody>
</table>


However, as figures 2.4 and 2.5 show, there are significant sectoral and state differences. In particular there is a much higher proportion of 12-hour shifts in the non-coal area and in Western Australia. In W.A, we can see that some form of 12-hour shift arrangement predominates in the production area (93%), while in N.S.W. at 16%, and in the coal industry as a whole (25.4%), the opposite is true. On average, Queensland (at 50%) lies between the Western Australian and New South Wales extremes, with Queensland virtually a mirror image of NSW with respect to the distribution of shift patterns. In Queensland, 85% of sites have a standard shift length in excess of eight hours; in NSW this figure is 39%. Western Australia, in comparison, has no sites with eight-hour shifts as their most common production shift.

Although coal mines account for over 50% of the number of Queensland mines, there is no difference between the frequency of 12-hour shifts in Queensland coal or metalliferous mines. The difference between Queensland and Western Australia is therefore not a function of the high proportion of coalmines in Queensland. The coal industry difference that appears in the data really reflects the New South Wales coal industry. *It is therefore not a function of differences between coal and non-coal in*
general, but between the NSW coal industry (particularly the underground coal sector) and other sectors.

Interestingly, of the ten Queensland mines that stated a desire to change roster arrangements, all were coalmines. The desired direction of change (identified in the qualitative responses) was towards increased shift length or hot seat provision in the production areas, and increased shift length, hot seat provision and rotating shifts for maintenance.

Figure 2.4 Standard shift lengths in production

![Diagram showing standard shift lengths in production. The graph displays the percentage distribution of shift lengths across various states and regions.](image)


A comparison of figure 2.4 with figure 2.5 shows that 12-hour shifts are less common in maintenance than in production. Note in particular that 12-hour maintenance shifts in WA are more than three times as common than they are in Eastern coalmines. Again note that while 50% of coalmine sites have maintenance shifts of 12-hours or more, another 32% have shifts of more than eight hours duration.

Figure 2.5 Standard shift length in maintenance

![Diagram showing standard shift lengths in maintenance. The graph displays the percentage distribution of shift lengths across various states and regions.](image)
There is an argument that the extent of compressed shifts is primarily a function of the isolation of a particular site. However, if we remove the long distance commuting (LDC) sites from the analysis, we can see that this is not the case. Figure 2.6 shows that 12-hour sites in production fall only 2 percentage points in Western Australia and around 7% in Queensland. We can therefore conclude that compressed shift arrangements are not simply or predominantly a function of the isolation of the mines.

**Figure 2.6 Shift length in production (excluding LDC sites)**

There is an argument that the extent of compressed shifts is primarily a function of the isolation of a particular site. However, if we remove the long distance commuting (LDC) sites from the analysis, we can see that this is not the case. Figure 2.6 shows that 12-hour sites in production fall only 2 percentage points in Western Australia and around 7% in Queensland. We can therefore conclude that compressed shift arrangements are not simply or predominantly a function of the isolation of the mines.
One question that can justifiably be asked is whether shift length is at least partly determined by mining method. In other words, do we find that open-cut mines are more likely to have compressed shifts than are underground mines, where (arguably) the environment is less suited to long working days? Table 2.6 below reveals that compressed shifts are far more common in open-cut environments. 67% of all open-cut mines have their main shift length at 12 hours, while in the underground sector this figure is 40%. Still, it is significant that 40% of underground mines have a standard 12-hour shift length in the production area. The figure is a little less for maintenance, both in open-cut and underground mines.

### Table 2.6 Shift length by mining method: Production only

<table>
<thead>
<tr>
<th>Standard Shift Length</th>
<th>Open-cut</th>
<th>Underground</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 hours or less</td>
<td>10 (13.7%)</td>
<td>29 (36.7%)</td>
</tr>
<tr>
<td>8 - 12 hours</td>
<td>14 (19.2%)</td>
<td>18 (22.8%)</td>
</tr>
<tr>
<td>12 hours or more</td>
<td>49 (67.1%)</td>
<td>32 (40.5%)</td>
</tr>
</tbody>
</table>


### The number of consecutive shifts

Standard shift length is only one factor associated with how shifts are worked. The ways shifts are compressed (or extended) are important components of roster design and are highly significant for OHS, family and social life. The major identified differences in shift and roster patterns were related to sector and to state. As figures 2.7 and 2.8 show, the trend towards multiple consecutive shifts is most marked in Western Australia and in the non-coal sector.

In the coal sector, only 1-2% of sites work more than seven shifts in a row, with between 86% (production) and 94% (maintenance) working 5-6 days in a row. In the non-coal sector, 28% work 14 shifts in a row; in Western Australia this rises to over one-third (34%). The figure for WA is significant since we saw previously that 93% of sites in production work 12-hour shifts. For Queensland, half the sites reported standard 12-hour shifts. The difference between Queensland and Western Australia is not attributable to the high proportion of fly-in/fly-out operations in WA. Even eliminating Queensland’s LDC sites, WA has proportionally more sites operating 12-hour shifts and with a greater number of consecutive shifts. A "coal industry effect" is noticed even in Queensland, where about one-third (6 of 20) of its coalmines operate a three or four day roster.

**Figure 2.7 Maximum number of consecutive shifts worked (production)**
As figure 2.8 shows, the position is similar for maintenance workers.

**Figure 2.8 Maximum number of consecutive shifts worked (maintenance)**

Figure 2.9 shows that almost one-third of sites that work on 12-hour shifts also work them for 14 days in a row. In WA this figure is over one-third and in Qld it is 23%. No NSW 12-hour sites work any more than four days in a row. In Queensland over 50% of sites with 12-hour shifts work them five days or more in a row, compared to 81% of WA sites. Even when we excluded fly-in/fly-out operations the relative differences remained. It would appear, therefore, that shift patterns are more than just a function of the relative isolation of the mine, although this does have some effect.

**Figure 2.9 Maximum number of consecutive shifts 12-hour sites (production)**
As we saw earlier, the relative isolation of the mine was not strongly associated with the likelihood of the mine to have compressed 12-hour shifts. However, the intensity of the compression appears to be influenced by the relative isolation of the mine. Figure 2.10 shows that when LDC sites are removed from the analysis, the percentage of rosters where the shifts are worked in very long runs of consecutive shifts (i.e. 14 or more) falls markedly, especially in Western Australia. It is significant, however, that even at sites where employees are commuting on a daily basis, there are still many sites where the shifts are heavily compressed. For instance, almost 40% of sites in WA have shifts that operate seven days or more in a row, and in Queensland this figure is around 35%.

Figure 2.10 Maximum number of compressed shifts (production only) excluding LDC sites
The roster cycle

There were some reported differences between maintenance and production workers in the type of roster cycle, with maintenance workers almost 10% less likely to work rotating shifts (47%) than production workers (57%), (Table 2.7).

Table 2.7 Type of roster cycle for production and maintenance employees (per cent)

<table>
<thead>
<tr>
<th>Type of roster cycle</th>
<th>Production</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating</td>
<td>57.2</td>
<td>47.3</td>
</tr>
<tr>
<td>Fixed</td>
<td>42.8</td>
<td>52.7</td>
</tr>
</tbody>
</table>


Ordinary hours of work

We know from other data that average hours of work have apparently increased in Australia in the last 15 years. We also know that the mining industry has the longest ordinary and total hours profile of all industries. The survey confirms this, showing that over 60% of all sites have average ordinary working hours well in excess of 40 per week.

Figures 2.11 and 2.12 show differences between coal and other mines, with coal mines again less likely to report very long ordinary hours. Again, in terms of state differences, Western Australia is above the all mines Australian average. Queensland has a longer ordinary hours regime than NSW, but not as long as WA.

Figure 2.11 Average ordinary weekly hours (production)
Again, community setting was an important factor in hours of work, with longer ordinary weekly hours associated with the relative isolation of the mine site (Table 2.8).
Table 2.8 Ordinary hours by community setting: Production and maintenance (per cent)

<table>
<thead>
<tr>
<th></th>
<th>Production community</th>
<th>Maintenance community</th>
<th>Production isolated</th>
<th>Maintenance isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 40</td>
<td>46</td>
<td>57</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>41 – 48</td>
<td>38</td>
<td>31</td>
<td>26</td>
<td>28</td>
</tr>
<tr>
<td>48 – 56</td>
<td>11</td>
<td>10</td>
<td>40</td>
<td>41</td>
</tr>
<tr>
<td>56 – 84</td>
<td>4</td>
<td>2</td>
<td>26</td>
<td>22</td>
</tr>
</tbody>
</table>

Source: ACIRRT Mining ILO Survey, February 2000 (‘community’ n=115) (‘isolated’ n=65).

Hours of work on 12-hour sites

Figure 2.13 shows the trends for ordinary average hours of work on sites where 12-hour shifts are the most common arrangement (all mines). It shows that longer average ordinary hours appear to be associated more strongly with 12-hour shifts. Just over 50% of 12-hour sites have ordinary average hours in excess of 49 per week, compared with an average of 31% for all sites. In principle, there should be no difference between the average weekly hours of work at 12-hour shift sites compared with any other shift/roster arrangement. This is because 12-hour shifts are meant to be worked within a compressed hours regime, not an extended hours regime (see Wallace, 1998). The longer average hours associated with the 12-hour sites suggests that many of these arrangements are being worked within an extended hours regime rather than in a compressed regime.

Figure 2.13 Hours of work in 12-hour shift sites (production)
2.5 Overtime arrangements

Overall, approximately 70% of both production and maintenance employees worked overtime on either a regular or occasional basis. (Table 2.9). This overtime is in addition to any mandatory overtime already absorbed into standard hours as a result of an industrial award, agreement or individual contract.

Table 2.9 Overtime arrangements for production and maintenance employees (per cent)

<table>
<thead>
<tr>
<th></th>
<th>Production employees</th>
<th>Maintenance employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular overtime</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>Occasional overtime</td>
<td>40</td>
<td>36</td>
</tr>
<tr>
<td>No overtime</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

Source: ACIRRT Mining ILO Survey, February 2000 (‘production’ n=152) (‘maintenance’ n=149).

The inclusion of mandatory overtime is a common feature where 12-hour shift arrangements have been introduced. This may explain why WA sites are less likely to be working additional overtime (figure 2.14). Figure 2.14 also shows that coal mines are much more likely to work regular overtime than the non-coal sector. This is
because their ordinary average hours are lower and these employees are compensated separately for overtime worked.

**Figure 2.14 Overtime worked (production)**

![Overtime worked (production)](image)

Derived from: ACIRRT ILO Survey, February 2000 (‘all sites’ n=152) (‘coal’ n=82) (‘non-coal’ n=70) (‘Qld.’ n=35) (‘NSW’ n=49) (‘WA’ n=44).

**How overtime is worked**

Of the 70% of employees who did work overtime, the large majority worked less than eight hours per week, with over one-third working 4-8 hours. Again, there are differences between the production and maintenance areas (Table 2.10) with maintenance workers more likely to work fewer overtime hours (i.e. under 4 hours per week) but production workers more likely to be working substantial overtime.

**Table 2.10 Additional Overtime: Production and maintenance (per cent)**

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4 hours</td>
<td>46.0</td>
<td>49.5</td>
</tr>
<tr>
<td>4 - 8</td>
<td>36.0</td>
<td>37.1</td>
</tr>
<tr>
<td>8 - 12</td>
<td>11.0</td>
<td>9.3</td>
</tr>
<tr>
<td>12 or more</td>
<td>7.0</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Source: ACIRRT Mining ILO Survey, February 2000 (‘production’ n=152) (‘maintenance’ n=149).
The differences between production and maintenance continue when the question is looked at in terms of the community setting of the mine. Table 2.11 shows that (perhaps not surprisingly) isolated sites are more likely to be undertaking substantial additional hours of overtime (12 or more per week) than those in a community setting. For example, 35% of production employees in a community setting undertake 12 or more hours of overtime per week compared with 85% of those in mining towns and isolated sites. Less than 2% of production workers in isolated settings undertake less than eight hours compared with 40% of those in a mixed community setting. The figures for maintenance workers show a similar pattern.

**Table 2.11 Overtime worked by production and maintenance employees, by community setting (per cent)**

<table>
<thead>
<tr>
<th></th>
<th>Production Community</th>
<th>Maintenance Community</th>
<th>Production Isolated</th>
<th>Maintenance Isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 8 hours</td>
<td>40</td>
<td>45</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>8 – 12 hours</td>
<td>25</td>
<td>28</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>12 or more hours</td>
<td>35</td>
<td>27</td>
<td>84</td>
<td>75</td>
</tr>
</tbody>
</table>

Source: ACIRRT Mining ILO Survey, February 2000 (‘community’ n=115) (‘isolated’ n=65)

What is perhaps surprising is the way such overtime is worked. Among those miners working standard 12-hour shifts, the most common method of undertaking additional overtime is through additional shifts (Table 2.12).

**Table 2.12 Method of increasing overtime by shift length: production and maintenance employees (per cent)**

<table>
<thead>
<tr>
<th></th>
<th>Less than 12hrs (Production)</th>
<th>12-hours (Production)</th>
<th>Less than 12hrs (Maintenance)</th>
<th>12-hours (Maintenance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extend shift</td>
<td>36.9</td>
<td>22.5</td>
<td>32.8</td>
<td>30.3</td>
</tr>
<tr>
<td>Additional</td>
<td>18.5</td>
<td>62.5</td>
<td>19.4</td>
<td>45.5</td>
</tr>
<tr>
<td>Combination</td>
<td>44.6</td>
<td>15.0</td>
<td>47.8</td>
<td>24.2</td>
</tr>
</tbody>
</table>

Source: ACIRRT Mining ILO Survey, February 2000 (‘production’ n=152) (‘maintenance’ n=149).

This means that over one-third of production workers on 12-hour shifts do additional overtime by extending the shift (23%) or some combination of extension and addition
For maintenance workers, over 30% extend the shift while almost one-quarter undertake a combination of additional shifts and extension of shifts.

*It is important to note that a key design principle applied to 12-hour shifts is that they should not be routinely extended by overtime unless in emergency situations.*

### 2.6 Impact assessment and fatigue management of shift rosters

Respondents were asked whether or not the current roster pattern was assessed before implementation. Of those who answered (144), around 60% answered yes and around 40% answered "no" with coal mines again more likely to answer positively. However, when asked whether they could nominate who had undertaken the assessment, the figure falls away for all states and sectors. While not detailed here, the figures fall away again when sites were asked (in qualitative components) to detail the exact measures used in the assessment. *This suggests that assessments may not be as robust as first indicated by sites.*

**Figure 2.15 "Has the impact of the roster been assessed?" (Production and maintenance)**

![Bar chart showing impact assessment and fatigue management of shift rosters](image)

<table>
<thead>
<tr>
<th>State</th>
<th>Impact Assessed</th>
<th>Nominate Assessor</th>
</tr>
</thead>
<tbody>
<tr>
<td>All mines</td>
<td>60.4%</td>
<td>45.9%</td>
</tr>
<tr>
<td>Coal</td>
<td>64.1%</td>
<td>53.4%</td>
</tr>
<tr>
<td>Non-coal</td>
<td>57.4%</td>
<td>36.3%</td>
</tr>
<tr>
<td>Qld.</td>
<td>53.7%</td>
<td>47.0%</td>
</tr>
<tr>
<td>NSW</td>
<td>56.1%</td>
<td>42.3%</td>
</tr>
<tr>
<td>WA</td>
<td>47.4%</td>
<td>40.7%</td>
</tr>
</tbody>
</table>

Derived from: *ACIRRT ILO Survey, February 2000* (‘impact assessed’ n=144) (‘able to nominate an assessor’ n=49)

**Contractors**

We collected only limited information on contractors because we chose to separate direct employees from contractors and cost prohibited collecting separate detailed information on contractor rostering arrangements. We did, however, collect information on the proportion of the workforce that were contractors.
Table 2.13 Proportion of workforce who are contractors (per cent) Production Maintenance

<table>
<thead>
<tr>
<th></th>
<th>Aust.</th>
<th>Qld.</th>
<th>NSW</th>
<th>WA</th>
<th>Aust.</th>
<th>Qld.</th>
<th>NSW</th>
<th>WA</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>10.1</td>
<td>8.8</td>
<td>14.6</td>
<td>7.4</td>
<td>5.3</td>
<td>8.3</td>
<td>2.6</td>
<td>7.4</td>
</tr>
<tr>
<td>&lt;5%</td>
<td>16.8</td>
<td>14.7</td>
<td>22.0</td>
<td>14.8</td>
<td>6.6</td>
<td>-</td>
<td>12.8</td>
<td>14.8</td>
</tr>
<tr>
<td>5-9</td>
<td>15.4</td>
<td>20.6</td>
<td>22.0</td>
<td>9.3</td>
<td>11.2</td>
<td>25.0</td>
<td>10.3</td>
<td>9.3</td>
</tr>
<tr>
<td>10-24</td>
<td>20.8</td>
<td>26.5</td>
<td>19.5</td>
<td>16.7</td>
<td>25.7</td>
<td>36.1</td>
<td>28.2</td>
<td>16.7</td>
</tr>
<tr>
<td>25-49</td>
<td>7.4</td>
<td>2.9</td>
<td>4.9</td>
<td>14.8</td>
<td>17.1</td>
<td>11.1</td>
<td>28.2</td>
<td>14.8</td>
</tr>
<tr>
<td>50-74</td>
<td>11.4</td>
<td>8.8</td>
<td>7.3</td>
<td>13.0</td>
<td>14.5</td>
<td>8.3</td>
<td>7.7</td>
<td>13.0</td>
</tr>
<tr>
<td>75-99</td>
<td>3.4</td>
<td>2.9</td>
<td>-</td>
<td>5.6</td>
<td>5.9</td>
<td>-</td>
<td>2.6</td>
<td>5.6</td>
</tr>
<tr>
<td>All</td>
<td>14.8</td>
<td>14.7</td>
<td>9.8</td>
<td>18.5</td>
<td>13.8</td>
<td>11.1</td>
<td>7.7</td>
<td>18.5</td>
</tr>
</tbody>
</table>


Table 2.13 shows that the use of contractors within the mining industry is significant. Forty-one responses were received from Queensland. Of these responses, five mines (15%) claimed to be operating with a 100% contract production workforce. Queensland is more likely than NSW (but second to Western Australia) to have the most mines with a large proportion of contractors in the workforce. This state difference is most marked in the maintenance area. For example, 37% of WA mines have more than 50% of their maintenance workforce as contractors, compared with Queensland where 19.4% of mines have more than 50% of their maintenance workforce as contractors. NSW has a lower proportion for both work areas than WA or Queensland.

2.7 Summary

Analysis of the data indicates that there are significant differences between sectors (coal and metalliferous and open-cut and underground) and some differences at state level. Although state aggregate responses initially appear to be mainly an industry concentration effect (for example coal mining is concentrated on the eastern seaboard), Western Australia stands out by showing some features that do not appear to be explicable by the type of mining.

The data in the tables and figures has therefore been presented to indicate these sectoral and state differences. In most instances, Australian averages have been given for coal and metalliferous and state level comparisons made among the three main mining states of Queensland, New South Wales and Western Australia.
Overall, the results appear to support industry information about a strong trend towards the introduction of 12-hour shifts and multiple consecutive shifts. These trends are most apparent in the non-coal mining areas (also the least unionized) and in certain states (such as WA). Significantly, rosters with long periods of compression are not just a feature of isolated or long distance commuting sites, although they are more common in these settings. In both Western Australia and, to a lesser extent, in Queensland, these rosters are also a feature of mines where employees commute on a daily basis and where they are located within settled, mixed local economies.

Queensland generally falls between WA and NSW in terms of all trends associated with the rosters including shift length, hours of work, consecutive shifts and overtime. In Queensland, around half of all sites (in production) have 12-hour shifts as their major arrangement (far more than NSW at 15.7%, but far less than WA with 93%). However, a further 32% of Queensland sites have shifts in excess of eight hours.

Around 45% of all shifts in Queensland are worked seven or more in a row, with over 50% of 12-hour sites working them in excess of five in a row. In addition, there appears to be a desire to increase shift length at those sites that nominated an intention to change their roster. While some of these trends might be associated with the increase in isolated and long distance commuting sites in Queensland, it is unlikely that they represent the full explanation. Further research is required in this area.

Finally, there appears to be a relationship that warrants closer attention between the incidence of 12-hour shifts and longer average hours of work. As noted above, 12-hour shifts are usually introduced as part of a compressed rather than an extended hours regime. In this form they have usually been introduced by management with the agreement (usually, but not always) of employees. At least in theory, there is no structural reason for these rosters to have a longer hours profile than, say, an eight-hour regime. The explanation for longer hours associated with 12-hour shifts must therefore lie elsewhere. Our data and research to date does not allow us to speculate on the reason behind this relationship. But given the health, safety and social implications associated with very long hours of work, it is an explanation worthy of examination. We turn now to exploring in brief some of these implications.

3. Implications of working time trends for the Australian mining industry

The emergence of longer working hours and a widespread extended shift work regime in the Australian mining industry is related to a convergence of complex factors. These include economic and competitive pressures within the industry, the absence of legislated and accepted standards, structural change in the Australian labour market, the culture of the unions and companies involved, and an increasingly decentralized industrial relations environment that has prioritized labour flexibility and productivity above other matters. Similarly, the implications resulting from these changes are multi-factorial and include issues such as occupational health and safety, performance impairment, productivity, quality of working life, social and family and community impact.
Research in some of these areas is sparse and findings not always directly applicable to the Australian rosters and particular mining environments cited in chapter 2. Moreover, the industrial, legal and commercial sensitivities associated with the issues of shift length and working time in the mining industry have meant that where research has been undertaken, the results often remain internal to the organization, or are "commercial in confidence" (for example Heiler, Baker and Bretherton, 2000). Where reports are publicly available (for example QMC, 2000; AMMA, 1998), few have been subject to peer review. This means that some of the implications we briefly overview in this section are rather speculative and point to the need for further work in some of the areas.

In the context of this Working Paper it is not practicable to explore all the issues indicated above. Nor is it possible to discuss in detail all the implications of extended shift regimes in the Australian labour market in general and the mining industry in particular. We will, however, try to identify some key areas indicated in the literature and which surfaced in the quantitative and qualitative components of the research in this project that might have a significant impact on health, safety, equity and industrial relations in the industry. It was apparent that there is a level of concern among employers, employees and their unions, as well as regulators, about the health, safety and community impact of these structural trends in the industry. There is also, however, a considerable degree of industrial volatility and uncertainty that is not yet resolved and which may impede progress on the matter.

We conclude that it is important for the industry to address the issue of all shift work, and in particular long hours and extended shifts (i.e. intensive work schedules) in a systematic manner. One way forward is to manage the occupational health and safety hazards associated with shift rosters in a similar way to the treatment of other, more immediately obvious, physical hazards. Such an approach, we suggest, would assist in removing the question of shifts and hours from immediate industrial relations concerns and provide room for management, unions and regulators to develop effective strategies to address problems that are currently privately, but not always publicly, acknowledged. As we note further on, such initiatives are under way in several states, but much work remains to be done to operationalize the more pro-active management of shift work at a site level (Heiler, 2000).

We now sketch out some of the key areas of concern associated with some of the trends outlined in the first two chapters of the report.

### 3.1 Shift work and health

A major concern associated with the convergence of longer hours of work and extended work schedules relates to the potential health and safety effects for employees over both the short and longer terms. There is now widespread acceptance that, due to a combination of circadian rhythm disruption and a greater tendency for sleep decrement, there exists a range of identifiable health problems associated with shift work, particularly but not exclusively, night work. Some manifest themselves soon after starting shift work, others manifest themselves over the longer term (Costa, 1997). These effects are associated with both biological disruption and "lifestyle issues", such as poor eating and sleeping habits. These may combine to impair health,
safety, work performance and social participation. They may be summarized as including:

- **Biological responses** – due primarily to the disturbance of circadian rhythms and which are particularly associated with night work and early morning starting times.
- **Medical issues** – such as general deterioration in health which manifests in increased susceptibility to colds and flu; disturbances of sleeping and eating habits and, in the long run, more severe disorders associated with the gastrointestinal (colitis, constipation, indigestion, food cravings and peptic ulcer); neuro-physico (chronic fatigue, anxiety, depression) and, possibly, cardiovascular (hypertension, ischaemic heart disease) functions.
- **Shift work-induced lifestyle problems** – manifested in various complaints and disorders such as poor quality and inadequate quantity of sleep, lack of exercise, poor nutrition, and alcohol and substance abuse/overuse.
- **Social problems** – where attempts to balance work and family and social commitments can also lead to shift work-induced stress and/or declining levels of community participation.

Recent medical research also suggests that women who work shift work may experience a higher risk of miscarriage, low birth weight and pre-term delivery as well as experience erratic menstrual cycles.

Until recently there has been an historical tendency to see the biological and health disruptions caused by shift work and long hours as a cost associated with the job that was adequately compensated by shift "loadings" and financial remuneration. However, the tradition of rewarding or compensating employees who work in hazardous environments (such as noisy, dusty environments) is now past. There is a growing recognition that the hazards associated with biologically disruptive shift schedules need to be minimized as far as practicable. The general duty of care provisions that exist in all state OHS legislation require that hazards associated with work systems be eliminated or controlled as far as practicable. There is a growing understanding that this includes the biologically disruptive effect of shift work. The kinds of initiatives that we now see slowly appearing in the mining industry include education and information for employees and management about the risks associated with shift work, and strategies for improving how employees manage their lifestyle and non-work activities. To date, however, there has been less focus on the organizational responsibilities associated with ensuring that rosters are well designed to minimize biological disruption, and are implemented in a way that controls and properly schedules work in a way sensitive to the human need for adequate rest and recuperation (Heiler, 2000). Dealing with the health implications of intensive work schedules by focusing principally on individual responsibilities does not limit in any way the responsibilities of the employer to ensure that rosters are well designed and allow employees to prepare and recuperate adequately (Heiler, 2000).

**3.2 Fatigue and safety**
The principle safety concern associated with shift work is that of fatigue and the effect of fatigue on performance. As Fletcher (1999) pointed out, a useful way of understanding fatigue is to see it as both work-related and non-work-related. The distinction makes it possible to differentiate between fatigue generated primarily through the roster and its design and that generated by non-work-related activities. The distinction also allows relationships between the two to be more clearly identified and for the responsibilities of employers and management to be more clearly identified.

**Definition of "fatigue"**

There is no universally accepted operational definition of fatigue. Certainly, it is more than merely being sleepy and its causes are more complex than merely the duration or physical nature of the work, although it involves these factors. It is now generally accepted that fatigue can be best understood by differentiating its source, its various dimensions, and its impact on performance. For analytical purposes we can differentiate between work-related and non-work-related fatigue, even though the two are clearly related.

*Non-work-related fatigue*, as it applies to shift work, can be defined as a product of home and family circumstances, out-of-work activities, lifestyle (including drug and alcohol use), individual sleep patterns and problems, underlying health, family pressures and problems and poor strategies for coping with shift arrangements.

*Work-related fatigue* can be considered to be a product of both physical and work organizational factors including:

- The duration of work and pattern of break periods, total shift length, the number of consecutive shifts, the length of breaks between the shifts, and the number of consecutive shifts
- The time of day at which work or the rest breaks occurs, which varies for day, afternoon and night shifts and is related to sleep decrement.
- The starting time of the shift
- The history of work over the previous seven days, as the effects of sleep loss last more that a single day and may still be felt for up to a week after extended sleep disruption.
- The biological limits on recovering from fatigue. Humans have limits to the period of wakefulness before sleep becomes essential. Partial adaptation is possible, and varies with individuals, but complete long-term adaptation is not possible.

**The performance impairment effect of fatigue**
Probably as a result of the combination of work- and non-work-related fatigue, shiftworkers, depending on the nature of work, time of day, duration of work and the nature of the roster cycle, can experience performance impairment. In general, the effects of fatigue can be shown to have a similar performance impairment effect as alcohol (Dawson and Reid, 1997). This may result in:

- reduced and variable levels of alertness/concentration;
- slower response times and reduced physiological arousal;
- impaired hand-eye coordination;
- reduced cognitive function and critical decision-making;
- loss of situational awareness;
- higher error rate, reduced margins for error;
- a tendency to sacrifice accuracy for speed;
- failure to recognize the existence of a problem;
- reduction in secondary task function;
- increased stress, frustration, irritability.

Combinations of one or more of these symptoms in a workforce may lead to an increase in the incidence and severity of work-related incidents and accidents compared with the non-shift working population (see for example, Rosa (1995), Harrington, et al. (1998); Olson and Ambrogetti, 1998, for summaries of the effects of fatigue on performance). Performance impairment is more likely where work is repetitive, mundane and/or requires sustained vigilance. Lack of control or discretion over work tasks or rest schedules compounds the problem. Given the nature of such performance impairment, it is reasonable to infer that, if a significant proportion of the workforce is fatigued, productivity outputs are unlikely to be optimum.

### 3.3 Fatigue and the mining industry

In a mining environment, where heavy (and expensive) plant and equipment can be under the control of a single operator for extended periods, fatigue might pose a serious hazard. Many of the tasks are repetitive, require vigilance, are frequently undertaken in isolation (such as truck driving or process control) and are carried out in circumstances where operator discretion is often limited. Recent fieldwork undertaken in both coal and metalliferous mines has confirmed the following kinds of fatigue-related problems emerging at a site level (Heiler, 2000):

- operators falling asleep and driving off haul roads;
- loss of situational awareness common among truck drivers;
- increased equipment damage towards the end of the shift;
- lapses in concentration and increased errors especially at low circadian point in the early morning;
- impairment of secondary task functions and reduced critical decision-making capacities;
- poor performance where work is very repetitive, mundane and boring;
- increased absenteeism as a result of excessive overtime;
• loss of experienced personnel and increased stress among management;
• uncontrolled contractor hours;
• employees reporting sleep problems and disorders;
• dissatisfaction balancing work and family responsibilities.

These problems appear to be a result of the convergence of both long daily hours and long weekly hours. In other words, they are more likely to occur where the shift schedules are "intensive" rather than just compressed. Our survey data confirmed published and unpublished Australian Bureau of Statistics data that not only were total hours of work in the mining industry significantly longer than the Australian average but they appeared to be increasing. However, the survey also revealed that average hours of work tended to be greater in 12-hour sites than the industry average. This strongly suggests that although 12-hour shifts in the Australian mining industry are justified, and initially designed to reflect compressed work schedules, they appear to result in shift work arrangements typical of extended and intensive schedules.

The combination of long working days and long working weeks at some sites, extended either through asymmetric compressed shifts or through extensive additional overtime (in which both management and employees are complicit), has the potential to introduce fatigue-related health and safety hazards. There is now sufficient evidence (briefly noted above) to suggest the strong probability of a relationship between fatigue-related performance impairment and increased risks of errors, incidents and accidents. As the clear trend is towards more sites adopting 12-hour shift arrangements, the development of strategies to address potential hazards is becoming more urgent.

As noted earlier, there is a growing recognition of the need to manage more actively the effects of fatigue at a workplace level. In three states in Australia – WA, Queensland and NSW – legislation is either already in place or will be introduced to include the requirement to manage the effects of fatigue and shift work more proactively in the mining industry. In WA this has taken the form of a code of practice; in Queensland fitness for duty with respect to fatigue has been included in recent OHS mining legislation; while in NSW it has been recently inserted into the NSW Mines Inspection Rule 2000 covering the metalliferous and extractive industries. Either guidance notes or guidelines will be drawn up to accompany the requirements to implement procedures to deal with fatigue. As noted earlier, the general duty of care provisions found in state OHS Acts also require that the management of hazards associated with work systems be undertaken.

There are, however, a number of implications associated with confining fatigue management in mining within a narrow "fitness for duty" framework. First, locating the responsibility for fatigue management primarily within a fitness for duty framework might risk placing the responsibility for managing fatigue on the individuals themselves. The temptation may then be for employers to focus primarily on testing and monitoring (such as impairment testing), rather than addressing what might be the underlying and more systemic causes of these problems (Heiler, 2000).
Second, it may also mean placing most of the onus on individual preparation for and recuperation from the shift which, although critically important, is only possible if the design of the shift actually allows for adequate rest and recuperation. Thus, a principal focus on testing or improved coping skills is no substitute for ensuring that the roster is well-designed in the first place, that overall hours are kept under control, that rest and meal breaks are scheduled appropriately, that work is scheduled appropriately, and that employees and management understand the risks associated with shift work and fatigue.

Third, it is also the case that although a risk management approach to shift work and fatigue is practical and sensible it is, at present, underdeveloped within the mining industry (Heiler, 2000). There are significant gaps and obstacles associated with implementing a risk management approach. These include, but are not restricted to: lack of standardized measures and instruments; little research on how generic risks translate into a mining environment; and little validation or reliability associated with current control measures. In addition, the industrial relations obstacles associated with placing controls on overtime hours is an issue that currently confronts many sites nationally. At present, a risk management approach alone may struggle to control adequately the risks associated with some of the very long and intensive work schedules.

Moreover, although much of the recent emphasis has been on fitness for work and performance (issues generally associated with non-work-related fatigue such as the adequacy of the domestic recuperative environment, domestic and marital pressures, adequate nutrition, family dysfunction and the like), it is becoming more obvious that it is also the relationship between work-related and non-work-related fatigue that largely determines the ability to prepare for and recuperate from shift work. Concern for family and other caring responsibilities of employees are generally seen in the Australian context, as "soft" issues not fundamentally associated with performance or productivity. But they are indeed issues that are necessarily and fundamentally related to the ability of employees to handle shift work and different kinds of rosters.

3.4 Implications for work and family

There is limited research on the impact of compressed 12-hour and intensive work schedules on work and family issues in an Australian context. The following discussion is therefore necessarily reliant on a wider body of research dealing with shift work in general. Although published studies cover a range of very different shift roster patterns (night shifts, seven-day rosters, extended shifts), they all acknowledge that a worker’s ability to cope with various roster patterns is strongly influenced by social and environmental circumstances. Studies dealing specifically with the effects of shift work on family show that, unless managed cautiously, shift work can cause heightened levels of stress and disruption for the partners and families of shiftworkers (Hattery & Merrill 1997). Night shifts and the problems of sleep deficit are identified as specific problems that can disrupt workers’ family and social lives (Khaleque 1999, White & Keith 1990).

Unpublished research by ACIRRT on work/family impact at the Vickery mine at Gunnedah in Northwestern NSW (ACIRRT, 1998) found that the degree to which family units would be affected by shift work depended on the stage at which the
family was at in their life cycle, the responsibilities of the non-shift working partner, and the structure of the family within the local community. The report found that families where the female partner was also working and where the family was juggling work and child care responsibilities found it very difficult to cope with compressed 12-hour shifts. On the other hand, where the family unit could take advantage of the shift working partner’s time off during the day (either because the children were of pre-school age or were grown and had left home) were by and large more likely to cope better. Significantly, this study found that there were issues associated with transplanting compressed arrangements that emerged in isolated communities to settled communities such as Gunnedah. Nascent but potentially significant results of this study also found a two-way relationship between how the family unit coped and how the employee coped at work. It found that there was a statistically significant greater likelihood that employees whose families and partners were not coping well would also be the ones experiencing more fatigue-related problems at work.

The relationship between home life and work life is thus best described as interactive or bi-directional. (Beach, 1999). Worker stress, generated by employment conditions, can transfer to affect the physical and psychological health of cohabiting partners. Zedeck explored the relationship of the work/home conflict and concluded that satisfaction with a shift schedule is highest when workers are able to have time with family, children, friends and community (1983). Morrison & Clements’ study of live-in work arrangements (1997), Beach’s analysis of fly-in/fly-out arrangements (1999) and Smith & Folkard’s study of shift work (1993) all emphasized how attitudes to work, and limitations on a worker’s ability to spend time with family, can impact negatively on the worker and the family unit.

There is also some emerging evidence that the way in which the family unit copes with the shift work arrangements of the working parents, in turn, affects their behaviour and ability to cope at work. This suggests that such issues will inevitably be placed on the agendas of the social partners.

The degree to which shift work changes, and the move to extended and compressed shifts will be beneficial or detrimental will depend on a range of factors, including both non-work-related and work-related issues. These include the structure and demographics of the family unit, the design of particular rosters and the extent to which they support a balanced approach to work and family responsibilities, the nature of the local community and labour market, and the nature of changes occurring at the workplace itself. The identified issues clearly include generic issues that would apply to all sites, and regional and site specific issues with a local impact. This suggests that there is unlikely to be a single best practice model for general implementation. Rather, it suggests the more difficult process of developing strategies to counter known general risks, but strategies which rely on realistic and pragmatic assessments of potential risks and hazards at regional and site level. The development of such strategies cannot be achieved at an individual employer/employee level. It implies the need for effective social dialogue and the articulation of needs amongst the social partners.

3.5 Implications for local communities
There has been even less published work in Australia on the impact on local communities of changes to rosters and working time arrangements than on family issues. This is true for both the impact of LDC arrangements on families and local/regional communities and the impact of compressed and extended shifts on local settled communities. Some exceptions do exist; one was the research undertaken in central Queensland after a move to continuous rosters at a mine site in 1988 (Gibson, 1993). This explored the family and community impact of the roster change, albeit primarily from the perspective of women. Gibson found that the move to the seven-day roster in her community had had a detrimental effect on the relationship of employees with their children and partners. The change had also had a negative effect on activities in the local community, particularly social and sporting activities which relied on community members sharing in common free time. This detrimental impact on the local community was confirmed in recent unpublished research on compressed schedules at the Saraji mine in central Queensland (Heiler, Baker and Bretherton, 2000). This report found that family units were differentially impacted upon in ways outlined earlier. Significantly, it found a very detrimental impact on the local mining community which supported the mine. Over time, many families relocated to the coastal areas, employees stayed in town only to work their shift and then travelled back to their families. This had an impact on local business, schools and support services. As the population declined, so too did the local community infrastructure, creating problems for those families that remained in the town.

There has been little work on the community impact of long distance commuting arrangements for either family or regional communities. Work has been undertaken by Storey, et al. (1989) in Canada but this does not have direct applicability to the situation in Australia. It is fair to state that, considering the extent of these arrangements in both WA and Queensland, it is surprising that so little work has been undertaken. With respect to these LDC sites, the following kinds of issues need to be explored:

- short and long term impact on family life and relationships;
- viability of these arrangements over the longer term and the capacity of sites to retain staff and ensure continuity of skill and expertise;
- staff turnover;
- impact on short and long term employee health;
- implications for occupational health and safety;
- implications for regional and state economies.

Some work was undertaken by AMMA (1997) who surveyed 37 of their member companies in mining, hydrocarbons, contract drilling and catering. They collected descriptive information on issues such as turnover, employee assistance drug and alcohol management, costs and benefits to families and extra workplace demands. With respect to family impact, the study found that costs to the family included: pressure on the spouse to make decisions on their own; emotional price to be paid for a good material lifestyle; and strain on relationships including on the spouse, the children and social life. On the other hand, benefits were found to include a larger income and extra time with the family during the long blocks of time off.

More recent work (Iverson and Maguire, 1999) explored the relationship between job and life satisfaction in a remote mining community in Queensland. The authors found
that the ability to be fully involved in community activities was a non-work investment that provided an important outlet from the stress and boredom of the job and allowed families to spend more time together as a group. They found, however, that participation in community life was severely restricted for most employees due to the requirements of a rotating shift roster. This was further hampered by the inability of workers to change rosters. They concluded that there was a strong relationship between job satisfaction and life satisfaction and that inadequate appreciation had been given to the ways in which these factors impact on each other in remote communities.

3.6 Implications for trade union activity and industrial relations

The emergence of longer hours and longer shifts within the mining industry in Australia creates potential problems for unions and management alike. Privately, if not publicly, management, union officials and individual workers have all expressed reservations about the short- and long-term health, safety and social effects of long hours and extended rosters and the difficulty of managing these trends. In the qualitative research associated with this project numerous examples were given of near misses and even injury or equipment damage that were (as the parties were aware) probably fatigue-related but which were recorded as "operator error" or the result of some unforeseen outside environmental effect, such as "wet or slippery conditions". The industrial difficulty expressed by all parties was how to translate such awareness into (non-threatening) information from which effective preventative strategies could be developed.

The workforce in mining (as in other industries) has become less secure, with widespread downsizing and restructuring across the industry. Private lifestyles have developed based on the income associated with long hours and additional regular overtime. In this situation workers are naturally more likely to emphasize (even short-term) financial security than willingly agree to shorter hours or reduced shifts (with a consequent reduction in income) for occupational health and safety, industrial or other social reasons.

At the same time, management sometimes finds itself supporting extended shifts, in some instances due to perceived or actual gains in labour flexibility and productivity, and in others as a way of strategically placing itself in opposition to the perceived current industrial culture of some workplace. For the unions there is a conflict between seeking a reduction in hours on the basis of health and safety and employment levels, yet supporting members’ claims to preserve income levels in an increasingly insecure industry.

Response from the unions

In these circumstances, the unions have a limited ability to undertake collective action on health and safety, or any other issue, which may result in a loss of income to members. They may (and have) raise hours, safety and fatigue concerns in educational programmes. However, pragmatically, unions must balance such concerns against the obvious risk of alienating large parts of their membership which, in the current industrial relations environment, can opt for the short-term financial inducements associated with offers of individual contracts. In the foreseeable future the chances of
a shorter or even a controlled hours campaign in the mining industry appears highly unlikely. It seems that the risks associated with working extended roster arrangements are, at present, outweighed by the industrial and financial risks of opposing them. This is true, however, not only for unions but also for all parties involved and provides a major challenge for regulators.

3.7 Moving beyond the 12-hour shift debate

There is an acknowledged need to move beyond what can be simplistic arguments about the merits of standard shift length. In particular, the eight-hour versus 12-hour debate is largely unhelpful and can undermine more serious attempts by management and unions alike to manage these arrangements pro-actively and minimize risks associated with them. It focuses the debate on trying to prove the inferiority or superiority of one shift system over another and contributes little to the understanding of the real hazards, some known and some unknown, associated with shift work.

In fact, the unknown effects of extended and intensive work schedules were issues recognized by a recent report on shift work prepared for the Queensland Mining Council which, nonetheless, made strong claims that 12-hour shifts were associated with an improvement in safety standards in the industry (QMC, 2000; 28). On the internal evidence of the report itself this claim must, at best, be regarded as somewhat premature. The risks associated with shift rosters are multi-faceted and complex and cannot be dismissed (or confirmed) on the basis of limited and inadequate data. Far greater caution is required at the present time and a more sophisticated understanding must be applied. There will inevitably be specific hazards associated with compressed schedules, just as there will also be problems associated with extended work schedules, irrespective of whether they are worked under an eight-hour, 12-hour or any other shift length regime. In all cases overall shift duration (shift length, total hours of work, recovery and time of day effects) will interact strongly with the nature of the work task, the workload, the physical and psychological environment within which work is accomplished, and a range of non-work related factors.

But this does not make the issue of shift length irrelevant. There are some commentators (generally partisan) who continue either to characterize the debate in terms of eight hours versus 12 hours, or who try to assert that shift length is irrelevant since it is only one of a range of factors to be assessed and therefore not of primary concern. This is misleading. Simply because shift length is acknowledged as not the only factor involved with whether or not rosters pose minimum risks, does not mean that shift length is not a highly significant, if not critical factor. Indeed, the combination of extended days and extended weekly hours is very much uncharted waters in terms of the fatigue and safety effects, especially within a mining environment. For example, the extra preparation and recuperation required under compressed shifts is now becoming widely understood. It has implications for shift design and for ensuring that both shift length and total hours of work are carefully managed. Similarly, roster designs that do not allow time for biological and social preparation and recuperation due to extended work days, or which have long periods of compression in arduous or difficult environments (such as hot, humid underground environments), are problematic.
4. Conclusions

The trends towards longer hours, extended shifts and a more fragmented industrial environment, suggested by published data and confirmed in the research for this project implies that the changes in mining, and in Australian industry as a whole, are likely to be long lasting rather than temporary or cyclical. Competition in commodity markets has pressured management to introduce labour cost-cutting measures such as labour shedding and more intensive shift roster arrangements. In addition, the opportunities provided by labour shedding have encouraged an extension of working hours accompanied by, in most cases, an extension of managerial prerogative over a smaller and more financially dependent workforce. In some cases, the introduction of compressed work schedules is a rational and appropriate response to the isolation of mine sites, especially in Western Australia and Queensland. The problem, however, is the expansion of arrangements that may be appropriate for long distance commuting sites into mines in settled communities where costs and benefits might be quite different.

The advantages, disadvantages and implications of these trends for society, individuals and companies are uncertain and uneven. Certainly, a long-term continuation of these trends would suggest that established concepts of social partnerships, embedded in an historically derived industrial regulatory system in Australia, might become problematic in the future. An immediate concern for health (including family and community health) and work safety is that the reduction of identifiable problems associated with shift roster patterns to a simple eight-hour versus 12-hour shift debate reduces the capacity of all parties adequately to address the issue.

The research for this project has shown, at least in broad outline, that the mining industry as a whole, and in particular the metalliferous sector, is increasingly adopting regimes of long weekly hours involving extended shift rosters resulting in an intensive work schedule in other than very isolated sites. It has also shown, again in broad outline, that the identification and management of these arrangements and the risks associated with them are, at best, haphazard. Where such arrangements are not sustainable in terms of health, safety or lifestyle, they have the potential to distort regional labour markets to the potential detriment of both parties.

The difficulty for both unions and management with respect to this issue is that both sides have been complicit in the development of some of these inappropriate intensive regimes. For management they have provided desired flexibility, productivity and an extension of workplace control. For unions and their members they have underpinned lifestyles based on anticipated income, albeit at some personal and social cost. Where the industrial tribunal system in Australia once limited the uncontrolled extension of hours of work, the current moves towards a more deregulated and individualized system of industrial relations provides no such bulwark. In these circumstances there is no easy escape route for either party. This suggests a challenge for regulators outside the industry.

The decline in the ability of the tribunal system to provide a circuit breaker may, however, in fact be countered by new obligations in the areas of OHS and anti-discrimination law. Management is aware of the potential affect of the general duty of
care obligations on shift roster design if that design is implicated, through fatigue for example, in a serious or traumatic incident. It is also apparent that "carers" provisions in anti-discrimination statutes may introduce external social obligations into roster design. The problem here is that change may be forced as a reactive response, rather than a proactive strategy.

While there will continue to be debates about the extent to which particular rosters and their design exacerbate or moderate the impact of shift work (and night work in particular), there is now widespread acceptance that shift work is itself a biological and social disruptor that creates hazards and problems.

The current challenge for the Australian mining industry is to acknowledge that these hazards exist and to develop preventive strategies that are capable of implementation within the diverse range of social, political and industrial environments in which mines conduct their physical operations.

References


CCH Australian Labour Law Reporter, (Sydney, CCH Australia Limited).


