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The evolution of employment, working time and training in the mining industry

Report for discussion at the
Tripartite Meeting on the Evolution of Employment,
Working Time and Training in the Mining Industry

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Context and outline of the report

The mining industry is not a major source of employment in global terms and, as Chapter 1 shows, employment in the formal part of this industry is falling, notwithstanding increased production and the opening of new mines. Productivity has risen across the board in the last ten years or so. New and refurbished mines are increasingly capital-intensive, on the one hand, requiring fewer workers per unit of production; but on the other hand, requiring several crews to enable continuous operation. But still direct employment has fallen. The increasing likelihood that new mines will be in remote locations, often in developing countries, means that attracting and retaining competent, diligent and motivated workers, including addressing family and community needs, requires special and sustained effort.

The situation in many long-established mining regions is often driven by restructuring programmes, as mines close and employment in areas that are often dependent on the mine falls dramatically. This necessitates the development and implementation of programmes that address the needs of former mineworkers, as well as ensuring continuity and replacement in the remaining workforce.

Mining is still a male-dominated industry. Although more women are working in all aspects of mining in some countries, any increase in female employment is generally from a very low base. The mining industry is also an employer of predominantly full-time workers, an increasing number of whom are contractors, including in development, production and maintenance. In many traditional mining countries, the average age of the mining workforce is considerably above that of industry as a whole.

These developments have implications for the widespread patterns of working time that maximize the use of equipment, and for training. Chapter 2 looks at trends in working time, the factors that have an impact on different forms of shift work, and at the means to address health and safety issues, including fatigue, arising from compressed shifts or extended working time.

Training is a link between employment and working time. It is the key to ensuring that new workers are competent and as productive and safe as possible, existing workers can keep abreast of changes that affect their world of work, and workers who are to leave the industry are able to continue to lead productive lives. Chapter 3 examines several different approaches to training in the industry and beyond.

Because of the importance of southern Africa in the world of mining – in terms of employment and production – and the incidence of HIV/AIDS in the region, Chapter 4 looks at how the entire mining sector – national and multinational companies, trade unions, NGOs and regulators – is addressing the pandemic that is affecting the mining workforce and their families, companies and communities.

In the light of the debate on the contribution of mining to sustainable development in the context of the World Summit on Sustainable Development and Beyond, Chapter 5 introduces the report of the Mining, Minerals and Sustainable Development Project as a stimulus for the Meeting to consider how the social partners and the ILO can contribute to ensuring that the mining industry can continue to operate in a context of sustainable development while ensuring decent work for all concerned.

Finally, Chapter 6 contains a summary of the issues discussed, together with some suggested points that might be the focus for discussion during the Meeting.

Background to the Meeting

The Meeting is part of the ILO's Sectoral Activities Programme, the purpose of which is to facilitate the exchange of information among constituents on labour and social developments related to particular economic sectors, complemented by practically oriented research on topical sectoral issues. This objective has traditionally been pursued by the holding of international tripartite sectoral meetings for the exchange of ideas and experiences with a view to fostering a broader understanding of sector-specific issues and problems, promoting an international tripartite consensus on sectoral concerns and providing guidance for national and international policies and measures to deal with the related issues and problems, promoting harmonization of all ILO activities of a sectoral character and acting as a focal point between the Office and its constituents, and providing technical advice, practical assistance and concrete support to ILO constituents in their efforts to overcome problems in ensuring decent work throughout the sectors concerned.

The Meeting was included in the programme of sectoral meetings for 2002-03 at the 279th Session (November 2000) of the Governing Body. It was subsequently decided (March 2001) to invite the governments of 18 countries, and 18 Employers' and 18 Workers' representatives after consultation with their respective groups in the Governing Body. However, as part of a continuing review of aspects of the Sectoral Activities Programme, the Governing Body, at its 283rd Session (March 2002), decided that participation in the Meeting would be open to the government of any ILO member State which indicated its wish to do so.

The purpose of the Meeting, as decided by the Governing Body, is to exchange views on the evolution of employment, working time and training in the mining industry, the social and labour implications of these developments for the parties concerned and the role of social dialogue in addressing them, using a report prepared by the Office as a basis for its discussions; to adopt conclusions that include proposals for action by governments, by employers' and workers' organizations at the national level and by the ILO; and to adopt a report on its discussions. The Meeting may also adopt resolutions.

Acknowledgements

The report is published under the authority of the International Labour Office. It was prepared by Norman Jennings, Senior Industrial Specialist in the Sectoral Activities Department. Valuable information and comment were obtained during interviews or correspondence with experts from mining companies, service organizations, trade unions, chambers of mines and governments in several countries. In addition, the report incorporates data from responses to a questionnaire that was sent to about 80 governments and from case studies carried out in Australia, Poland, Ukraine and the United States. It also draws on a working paper on working time in the Australian mining industry that was commissioned by the Sectoral Activities Department in 1999 and was published in 2000. Several ILO colleagues also provided useful comments on the draft.

1. Evolution of employment

Fewer mineworkers

Employment in the mining industry is changing in several ways for a variety of interrelated reasons: commercial, political, technological, demographic and social. The net effect, however, has been a steady fall in the number of people employed in mining, an industry that accounts for less than 1 per cent of the global workforce.

Since the early 1990s, when about 25 million people were estimated to be employed in mining, including 10 million or so in coalmining, the decline in employment has ranged from steady to more rapid at different times in different regions. Table 1.1 shows the evolution of employment in mining in selected countries. Only seven of the 29 countries show an increase in 15 years. Decreases over the period range up to 90 per cent. In the 29 countries for which data are available, there was a net loss of at least 5.5 million jobs in mining in the 15-year period to 2000, a fall of 45 per cent in these countries. Over half of those (3.2 million) disappeared in the five years 1995-2000, a fall of almost 32 per cent. Since there are several major mining countries absent from the list, it is likely that many more jobs were lost.

Table 1.1. Employment in mining: Selected countries, 1985-2000 ('000)

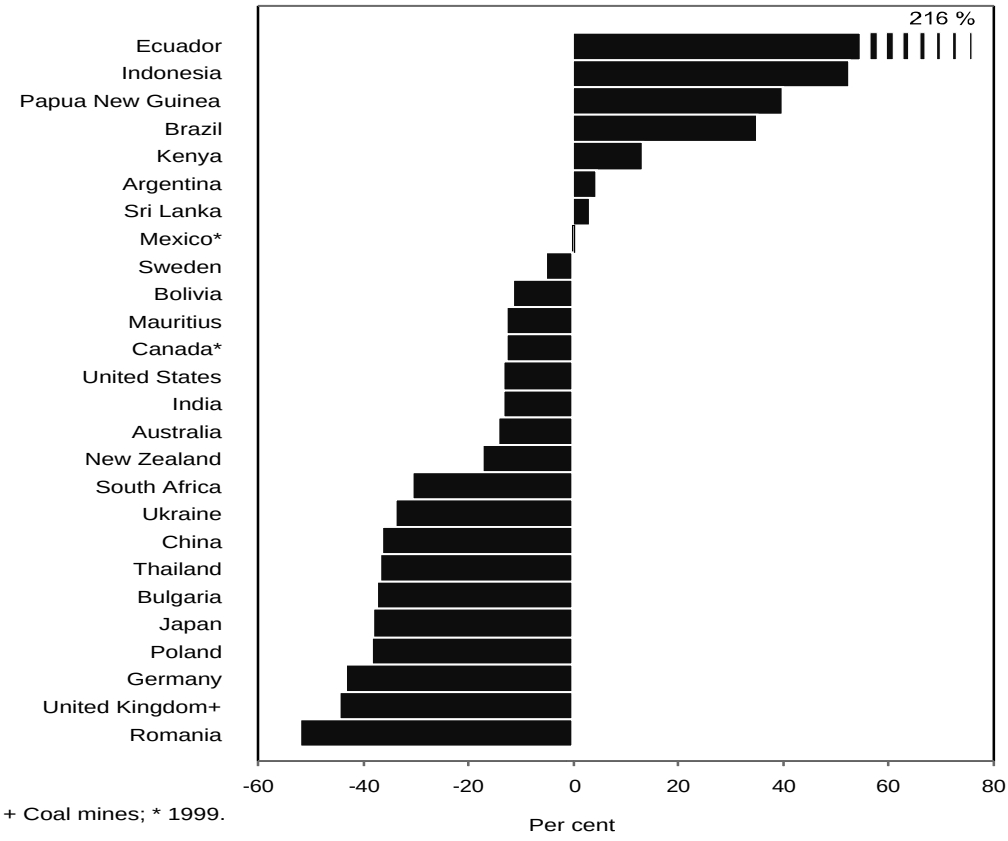
	1985	1990	1995	2000
Australia	84.0	66.0	56.0	48.0
Argentina	…	…	11. 9	12.4
Bolivia	70.0	73.5	52.5	46.6
Brazil	89.9	88.7	77.1	104.3
Bulgaria	…	94.8	62.3	39.0
Canada	77.7	73.6	61.1	53.4[1]
China	…	…	6 680.0	4 260.0
Ecuador	…	15.0[2]	26.7	84.5
Fiji	…	1.9	1.7	…
Germany	166.2	130.3	92.6	52.6
India	754.9	723.6	692.2	599.9
Indonesia	…	…	22.1	37.7
Japan	57.6	37.2	27.1	16.9
Kenya	4.8	4.2	4.6	5.2
Mauritius	…	0.7	1.6	1.4
Mexico [1]	83.0	95.6	67.7	68.0
New Zealand	…	3.4	3.7	3.1
Papua New Guinea	5.9	5.3	6.5	9.1
Philippines	62.9	57.5	23.9	…
Poland	…	…	350.6	216.7
Romania	204.9	221.0	160.2	76.9
South Africa	807.4	778.3	598.1	416.8
Sri Lanka	…	18.6	16.9	17.5

	1985	1990	1995	2000
Sweden	9.4	6.4	4.7	4.4
Thailand	58.4	21.8	26.7	16.9
Turkey	108.8	99.0	81.1	…
Ukraine	…	…	643.9	427.8
United Kingdom [3]	179.6	74.4	23.6	13.1
United States	343.8	314.6	261.0	226.6

… = Not available.
[1] 1999. [2] 1992. [3] Coalmines.
Source: Responses to ILO questionnaire.

Privatization and the subsequent closure of many formerly state-owned coalmines in Western Europe was already well under way at that time, but it continues to a certain extent today. In Australia and North America technological change and competitive pressures led to fewer workers per unit of production. As countries in Central and Eastern Europe and the former Soviet Union started a sustained programme of economic restructuring that affected all industries, particularly coalmines (see below concerning Poland, Romania and Ukraine), employment in what were generally regarded as grossly overstaffed mines started to fall as they prepared to operate in a market economy. Economic downturns have had an effect in several regions, including in China where many smaller mines have been closed for both market and safety reasons, and in South Africa when the price of gold fell suddenly. Figure 1.1 shows how employment in these countries has changed since 1995. The smaller rate of change in countries where employment in mining came under pressure earlier is clear.

Figure 1.1. Evolution of employment in 1995-2000: Selected countries (percentage change)



+ Coal mines; * 1999.

Source: Responses to ILO questionnaire.

Mergers and acquisitions throughout the mining industry in the past few years have concentrated ownership and led to rationalizations that have reduced workforces. As old underground deposits have become exhausted, new mines have tended to be less labour-intensive surface operations. Even if they were not, mines have been more capital-intensive and, even with continuous operation, employ fewer workers per unit of production than was formerly the case. Productivity, no matter how it is measured, has increased, sometimes substantially in many countries, including all countries that provided productivity data when responding to the questionnaire. In Australian coalmines productivity increased by 210 per cent in 1985-2000; in the United States the increase was 126 per cent, but 15 per cent in non-metal mines. Canada and India showed productivity gains of 103 per cent and 154 per cent respectively. Productivity also increased in Sri Lanka (54 per cent), Mexico (48 per cent), Papua New Guinea (40 per cent) and Germany (24 per cent).

Structure of the workforce

It is difficult to ascertain from the small sample above whether and to what extent the structure of the directly employed workforce has changed as jobs have been lost. Some increases in the proportion of employees engaged in production and processing activities, as opposed to non-production related work, have been reported. In the United Kingdom, for example, the proportion of employees who were directly involved in production rose from 77 per cent in 1985 to 99 per cent in 2000. The workforce contracted by 93 per cent in this time. In Bulgaria the proportion of production workers increased from two-thirds to four-fifths of the total; in Romania it rose from 85 per cent to 93 per cent; in Canada from 76 per cent to 82 per cent. In Mexico, however, the proportion fell from 80 per cent in 1985 to 70 per cent in 1999. Elsewhere the changes were minor as the proportion of workers engaged in production and treatment remained typically at about 80 per cent. The extent to which the proportion of production workers can be maximized, and at what level, depends on the structure of the industry and on how different tasks are defined. The extent of the use of contract workers and the tasks they carry out can have an important impact. Contract work is addressed later in this chapter.

Two broader issues that are related to employment – working time and training – are discussed in Chapters 2 and 3 respectively in relation to issues that are important to ensure that the fewer workers who are needed to produce the world's minerals are recruited, trained and maintained in such a way that the raw materials which provide us with a decent lifestyle are produced through decent work.

Restructuring of the mining industry

The creation of new employment and the management of redundancy are the most crucial but also the most difficult aspects of mine restructuring. New jobs are dependent on the approach taken to restructuring – from the planning stage – and on the people and administrations of mining regions, together with the economic development that leads to new jobs. Former coalmining regions of Western Europe and North America are proof that even notoriously grim old mining towns can have a new lease of life. But the transition is generally a long and difficult process requiring the understanding, patience and active involvement of stakeholders, supported by a solid social safety net. Clearly it is more difficult to attract new employment in a weak economic environment and in regions that have been solely developed for mining – as is often the case in Eastern Europe and even more so in the former Soviet Union. Thus the employment – or lack of employment – question has driven fierce opposition to mine closures. After a shaky start, however, the most important coal producers in these countries (Poland, Romania, Russian Federation

and Ukraine) have demonstrated that restructuring can commence successfully provided certain guidelines are followed (box 1.1).

Box. 1.1. Getting mining industry restructuring to work: Lessons from Poland, Romania, Russian Federation and Ukraine

Get the facts. A review of all important aspects and data of a country's mining industry puts the problem into the context of the country's overall economic and social development and helps build consensus between the government and donors on the need to reform. The review may encompass history, geology, markets, technology, management, social and environmental aspects, laws and institutions.

Obtain government support at the highest level. Invariably, a high-ranking government official is needed to defend and promote the restructuring agenda.

Separate "good" and "bad" mines. Cross-subsidies and non-transparent accounting have been major impediments to restructuring. The mines with a potential future and those that make the largest losses, and are thus the prime candidates for closure, should be unequivocally and quickly identified. Separate rules regarding investment, recruitment and possibly wage policies should be established for the mines to be closed and for other mines.

Agree and obtain a budget. Agreement between the government and mining industry officials on a budget for the industry can be a major breakthrough to commencing restructuring. It is most important to distinguish between subsidies for restructuring ("good subsidies") and operating subsidies ("bad subsidies"). The former must be secured as a matter of priority. Securing a budget and its priority use can bring reluctant mining officials on side for the restructuring programme.

Establish a special agency. Depending on the financial discipline of a country's mining industry and its government, it may be necessary to establish a special agency for the efficient implementation and proper funding of mine closures. Experience with coalmines has shown that closures under such an agency are faster and less costly than closures carried out by mine companies.

Improve the rules. Mine closures can be hampered by ambiguous or contradictory regulations and by their poor implementation. In such situations, however, mine closures should proceed because it is more important to stop the waste connected with continued operation. But the lessons learned should be applied to improve the rules and procedures for future closures.

Pay what is owed. The statutory benefits due to laid-off workers must be paid promptly and in full. Depending on the country, statutory benefits may include severance payments (including wage arrears), disability payments, free coal, accommodation and other benefits.

Help with new jobs. Public works, microcredits and employment subsidies can be effective tools to trigger the creation of new temporary and permanent jobs. They should be supported by training, counselling, job-search assistance, business incubators and information dissemination. While the applicability and success of individual measures will vary from site to site, it is important that an honest and visible effort is made to introduce as much and as diversified assistance as possible.

Engage the mining regions. The responsibility for new employment creation and regional regeneration should be shifted increasingly to the regions by involving regional and municipal administrations, and the public. This will help the transition from larger-scale unrealistic centrally planned and executed projects. Although often hypothetical due to lack of funds, such larger-scale project ideas have been a hindrance to restructuring because authorities refused to approve mine closures in the absence of what they considered appropriate new job-creation projects.

Source: World Bank Mining Department. Personal communication.

What the box does not highlight explicitly is the importance of engaging and informing the workforce and workers' organizations. These two elements – trust and information – underpin all restructuring programmes. All too often, however, they are not introduced until the process is well under way, rather than when the first signs are evident. The outcome is then generally unfortunate – for the industry, its workers and their families, and for the government agencies concerned.

When considering the removal of production subsidies and consequent mine closures, the pace of closure needs to be examined. Sudden closure in an area that is heavily dependent on a mine will have a major and, quite possibly, lasting adverse economic

impact on the local economy, even in a generally robust national economy, whereas phasing out operations smoothly will tend to have less of an impact. It is also likely to be less costly to provide "closure aid" that guarantees redundancy payments and enables an orderly closure than to deal with the shock of sudden closure. Government assistance for such an approach is being sought in the United Kingdom for a mine that employs 2,500 people and is facing closure due to continued financial losses and a lack of long-term coal reserves.[1]

One example of the importance of paying what is owed is to be found in Ukraine, where wages have seldom been paid on time. Often they are more than six months in arrears and only paid after industrial action. At the end of 2000 and 2001, $120 million and $110 million respectively were owed to coalminers, mostly to those in state-owned mines.

Evolution of employment in selected countries

The following information on the evolution of employment in mining in a range of countries over the last 15 years or so emphasizes the need for all concerned with the mining industry – the "stakeholders" – to be fully aware of the issues surrounding the provision of sufficient well-trained and motivated workers and the transition away from mining.

In the late 1980s the former Soviet Republic of Ukraine produced about 200 million tonnes of coal a year from 280 mines, with over 1 million people employed in mining and related services. Between 1985 and 2001, employment in the coalmines of the former Soviet Republic (1985) and then the Ukraine (2001) fell by almost 70 per cent while coal production fell by almost 50 per cent, as did the number of mines. There was therefore a significant increase in labour productivity over the period. But these gains were only realized in 1996-2001 when restructuring included mine closures. In 1985-95, employment and production fell more or less in step, each declining by about half. In 1996-2001, however, coal production remained stable at about 83 million tonnes a year, but employment fell by 39 per cent as mines were finally closed. Some of the economic dividends of restructuring are only now beginning to be realized, although labour productivity is still low compared with many other coal-producing countries. Productivity in underground mines is constrained by difficult geology, but there is no such constraint in surface mines, where labour productivity is still only about 45 tonnes per worker per month.

The situation in Ukraine's opencast and underground iron ore mines is rather different. Employment fell by 10 per cent in 1995-2000 when it was 70,100, 27,000 of whom were women. There were also 11,100 contractors.

The workforce in Ukraine continues to decline since there are only 65 people hired for every 100 who leave. Despite the fall in employment since 1995, however, the structure of the workforce has remained stable, with the proportion of production workers in the total workforce remaining at about 84 per cent.[2]

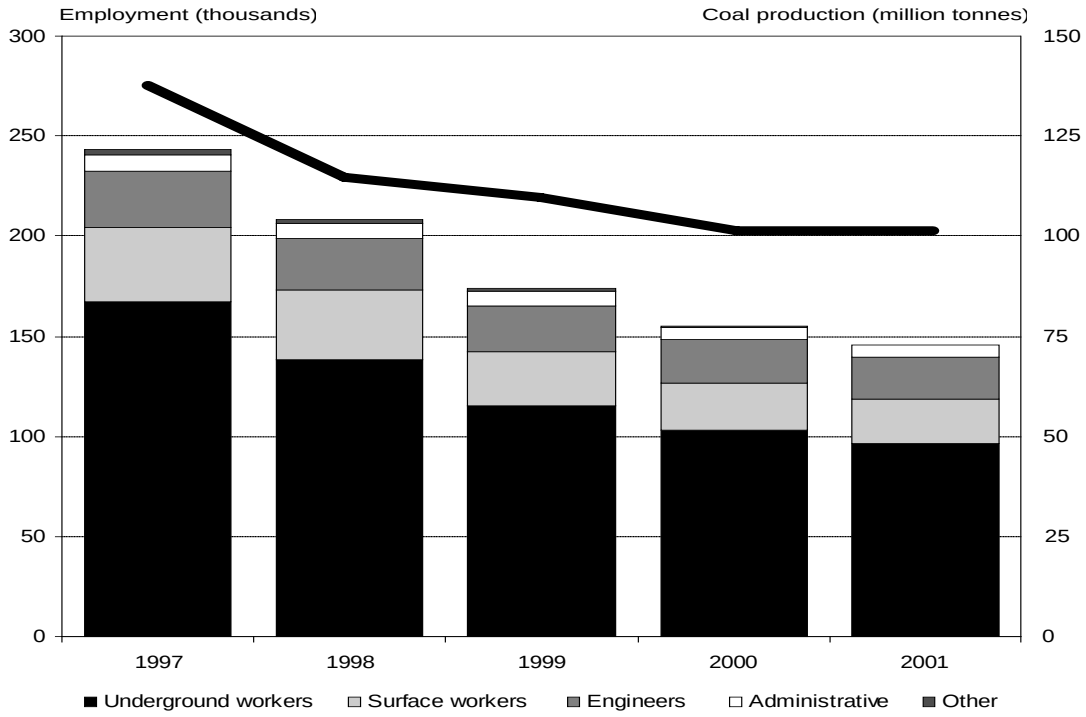
Restructuring of the coalmining industry in Poland started in earnest in 1998 with the conclusion of the World Bank's first coal sector adjustment loan (1998-2002) of $300

[1] *International Coal Report*, 25 Mar. 2002, p. 4.

[2] Tetyana Petrova, Ministry of Labour and Social Policy of Ukraine, unpublished study prepared for the ILO, 2002.

million. In August 2001 a second loan of $100 million was agreed. The coalmining workforce has decreased from 257,000 at the end of 1996 to 146,000 in December 2001. Throughout this period the proportion of women (10-11 per cent), administrative workers (4-4.5 per cent) and surface workers (15.5 per cent) in the workforce remained fairly stable. The proportion of underground workers, however, fell slightly over the five years from 68.6 per cent to 66.1 per cent of the workforce, whereas the proportion of technical engineers rose from 11.6 per cent to 14.1 per cent. Figure 1.2 shows how the composition of the coalmining workforce changed in 1997-2001, juxtaposed with coal production. As in Ukraine, productivity has increased in the past four years or so as mines have closed.

Figure 1.2. Poland: Evolution of employment in coalmines, 1997-2001



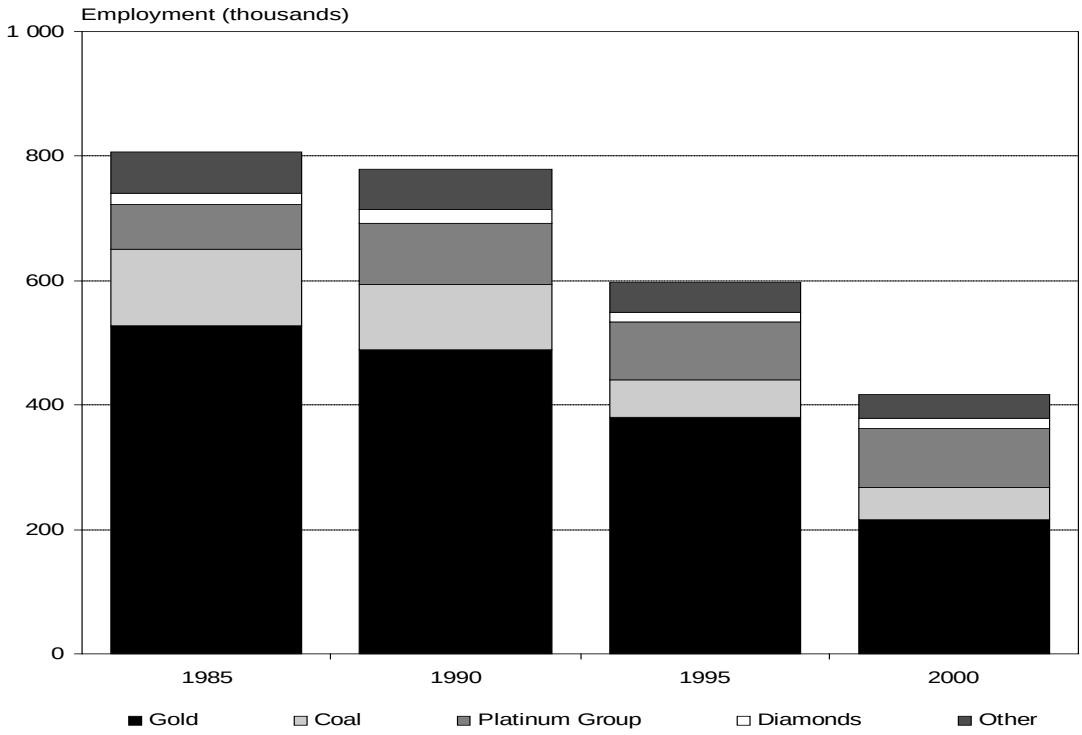
Source: Grzegorz Paździorek and Marek Gwózdź: *Restructuring of Polish mining: Selected issues*, unpublished study prepared for the ILO, 2002.

The bulk of those who were recruited in 1997 and 1998 in Polish coalmines (50 per cent and 80 per cent respectively) were people transferred from closed mines. Also, a significant proportion, about 1,500 each year, were people returning from approved leave – such as military service, maternity leave and unpaid leave – with the right to re-employment. From 1999, the number of graduates recruited to the industry fell dramatically from 600 to less than 100 a year. Despite massive separations, however, there has been a slight but steady increase in the average age of the workforce, with 36 per cent being over 40 years of age in 2001.

Recent changes in mining employment in South Africa have led to increased recruitment from within the mining area as opposed to previously when the bulk of mineworkers came from rural areas or from neighbouring countries (although the impact on the latter has been less marked). Nonetheless, many rural communities remain heavily dependent on mining as the primary source of income. In 1996, for example, in 15 districts in South Africa, one-third of the employed males worked in mining. Large-scale retrenchments hit such areas hard, especially where there was a high level of family

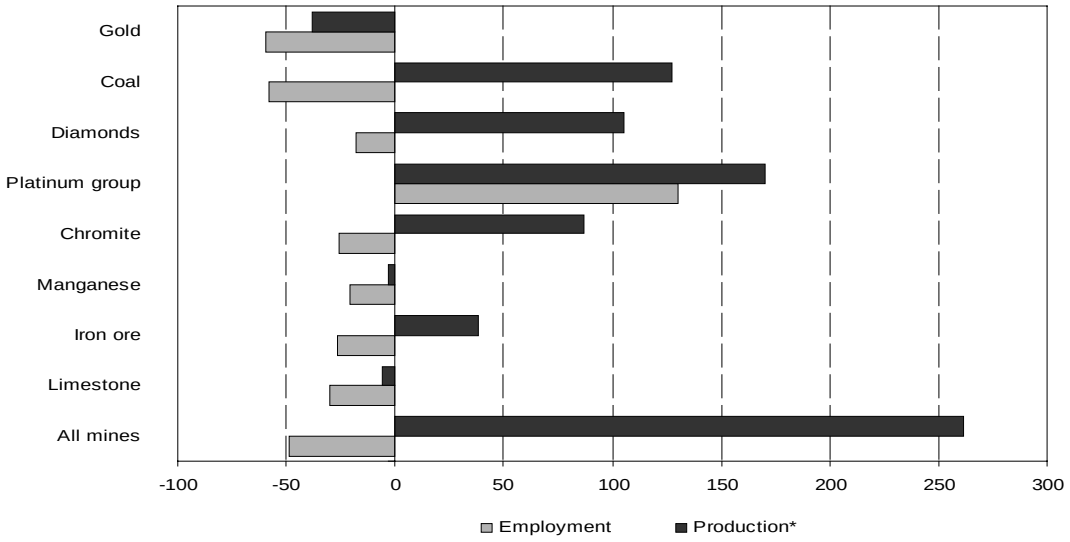
dependency.[3] Figures 1.3 and 1.4 show that, despite a 48 per cent drop in mining employment in 1985-2000 (in all major minerals except platinum), physical production and the value of global output have increased in every sector except coal and gold.

Figure 1.3. South Africa: Evolution of employment in mining, 1985-2000: Selected commodities



Source: Department of Minerals and Energy.

Figure 1.4. South Africa: Evolution of employment and production, 1985-2000: Selected commodities (percentage change over 1985)



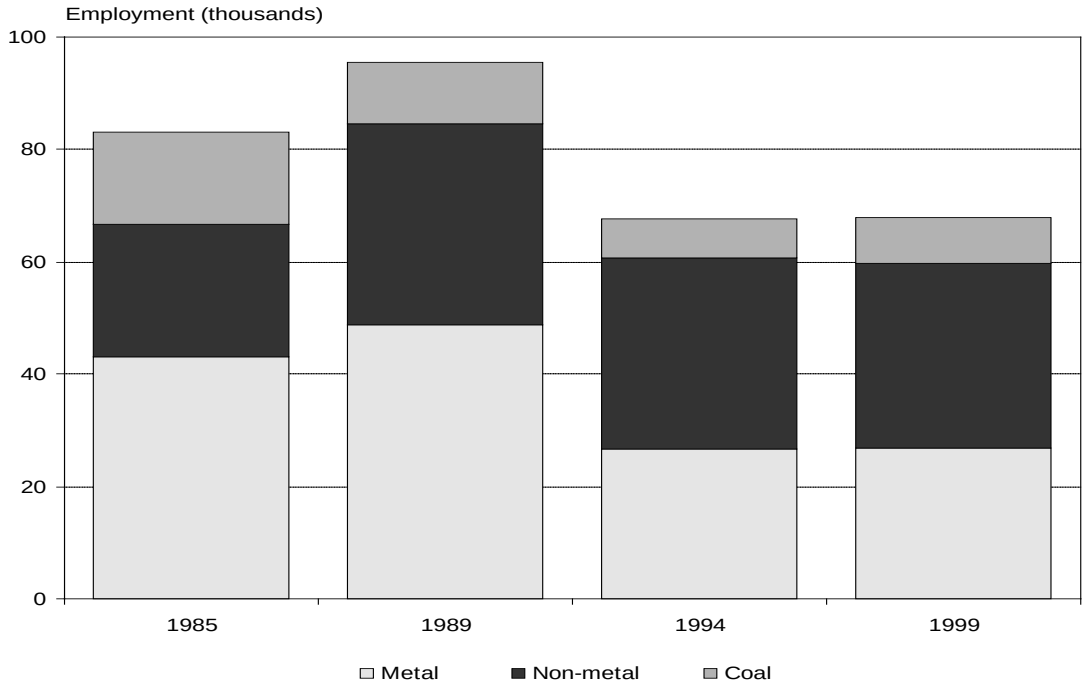
* Physical output for minerals; sales value for "all mines".

Source: ibid.

[3] University of Cape Town Business School: *The South African mining industry in the 21st century*, study prepared for the Chamber of Mines of South Africa (2000) (Chamber of Mines web site www.bullion.org.za)

In Mexico, employment plunged by about 30 per cent between 1985 and 1999, particularly in the metal mining sector where it fell by 45 per cent. But in the five years to 1999, mining employment remained fairly stable (figure 1.5).

Figure 1.5. Mexico: Evolution of employment in mining, 1985-99



Source: Response to ILO questionnaire.

Workforce reductions to continue?

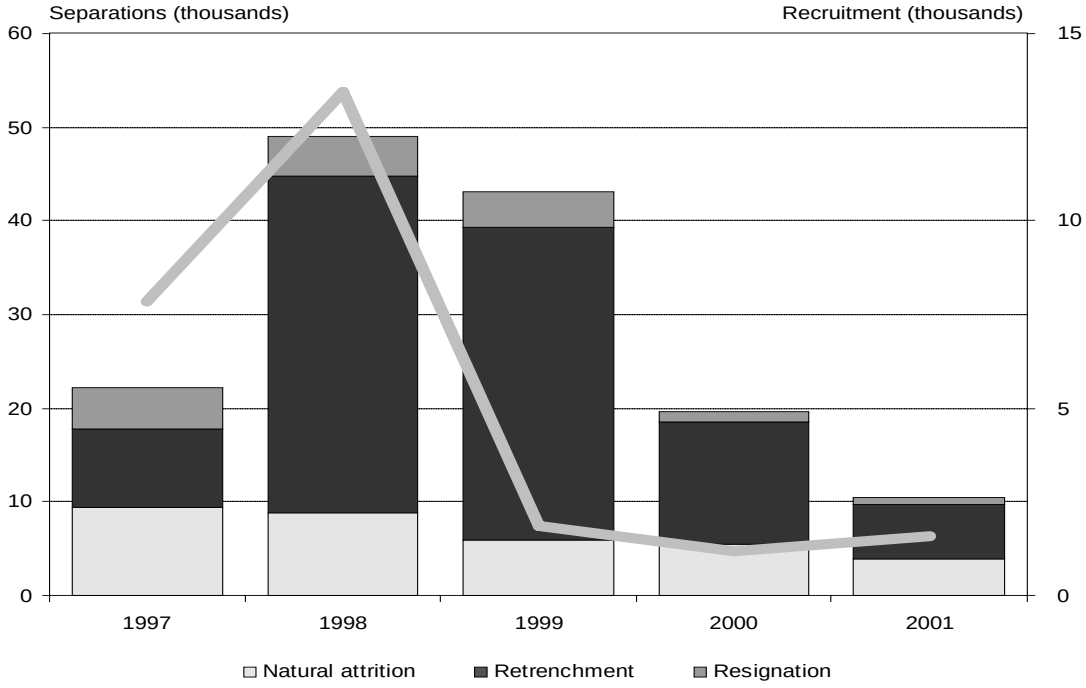
Employment changes that have taken place in the mining industry in other countries might not have been quite as dramatic as those in Central and Eastern Europe and the former Soviet Union in recent years but they have been substantial and sustained, driven by the intense competition in the international minerals markets, including as a result of mergers and acquisitions.

It is not possible to say whether the 32 per cent fall in employment in the past five years in 25 countries is representative of the global mining industry, nor to what extent the trend will be maintained or changed in the future. However, even from the limited sample in table 1.1, it is clear that, while mining employment has stabilized in some countries and is increasing in a few, there are likely to be further reductions in the mining workforce over the next five to ten years.

Dealing with retrenchment

Several examples of approaches to retrenchment show some common elements – payments, assistance, consultation. Figure 1.6 shows the nature of the retirements and dismissals that took place in Polish coalmines after 1997 and the level of recruitment.

Figure 1.6. Poland: Separation and recruitment in coalmines, 1997-2001



Source: Paździorek and Gwózdź, op. cit.

About 50 per cent of those who lost their jobs accepted early retirement. About one-quarter of the other workers who lost their jobs found alternative employment in service industries and various small manufacturing and other businesses. But finding jobs for laid-off mineworkers has become harder recently because of Poland's economic slowdown. The same is true in other countries.

In recognition of the imperative of assisting former mineworkers in Poland, $75 million of a new $100 million World Bank loan will be earmarked for various measures to assist laid-off miners. These measures include employment counselling, business advice, financial assistance and training of surface workers, including administrative staff, half of whom are women.[4]

In addition to assistance from the World Bank in addressing employment issues arising from restructuring, Poland is benefiting from the Phare programme of the European Union. Projects include the creation of new jobs for former mineworkers through the development of SMEs, providing vocational training to ex-miners, providing financial benefits to those who employ former miners, and providing financial advice to those who plan to set up their own business.

Between 1993 and 2001, the coalmining workforce in Ukraine decreased from about 870,000 to 328,100, a fall of 62 per cent. The reasons for separation from the industry were voluntary separation (40-45 per cent), retirement (10-15 per cent), retrenchment (10 per cent), and transfer to another enterprise (6-7 per cent).

Employment in coalmining in Australia decreased from 26,200 in 1996 to 18,850 in 2000 before rising to about 20,000 in 2001. Where contractions in the workforce have been negotiated with trade unions the outcome has been more equitable as far as workers are

[4] *International Coal Report*, 28 Aug. 2001, pp. 18-20.

concerned and has certainly resulted in less industrial action than when unions were not consulted. The principal incentive for a worker to leave is the extent of severance payments that can reach three weeks per year of service. Companies and/or local employment services that have government funding sometimes provide financial advice at the time of retrenchment and may provide training in jobseeking and advice on relocation. Although the incentive of retrenchment and severance pay was initially achieved through collective bargaining, it is now common practice even when collective bargaining does not occur.[5]

Under South African law, employers must consult (not necessarily negotiate with) workers' representatives on retrenchment programmes. But many retrenchment programmes have been subject to agreements between the social partners. They commonly specify a retrenchment package (e.g. two weeks wages per year of service, excluding payment for the one-month notice period which is usually not worked), a social plan that might include training for other work (see Chapter 3) and sometimes a relocation clause.

Contract work

Due to the complex nature of mining and the requirements necessary to operate a safe and productive mining enterprise, mine operators rely primarily on their own employees to carry out most functions at a mine. Thus, as might be expected, the level and type of subcontracting vary from site to site. It is increasingly common for both major maintenance tasks and routine equipment maintenance to be contracted out. Development work – such as shaft sinking (South Africa, United States) and the relocation of longwall equipment in underground coalmines (Australia, United States) – is contracted out at many mines. Part or even all of the production process might be contracted out at some opencast mine sites, particularly for the removal of overburden. At some opencast mines the entire mining process has been contracted out, with the mining company only becoming directly involved as an employer when the ore is delivered to the primary crusher.

The use of contractors can give companies additional flexibility and reduce their fixed costs. The other side of the coin is that the core business of mining companies could be considered to be operating mines rather than merely owning them. In principle, therefore, they should be able to operate their mines more effectively than a contractor and obtain the maximum return. This is the kind of issue that should be a component of social dialogue.

In the United States, specialized work activities, such as shaft sinking, equipment maintenance, drilling and blasting, construction activities, recovery operations, mandatory training and intermittent seasonal activities are contracted out because of lower cost, or because the specialist expertise that is required is not available to the operator. Such decisions are made on a mine-by-mine basis and depend on a variety of factors including cost, the technical nature of the work to be performed and its frequency. Some mines have reverted to full-time employees because the anticipated cost savings did not arise or the quality of service did not meet the company's standards.[6]

In India, a joint federal state government-owned coal company (Singareni Collieries Company Ltd.) is the first public sector coal company to engage contract workers to supplement its workforce. In this case, contractors remove overburden. Similar

[5] Construction, Forestry, Mining and Energy Union, Australia: *The Australian black coal industry*, unpublished study prepared for the ILO, 2002.

[6] Michael Peelish, unpublished study prepared for the ILO, 2002.

arrangements for other minor operations are being considered by the company. Coal India Limited, the principal employer, is being encouraged to explore the possibility too.[7]

In Ukraine 7-10 per cent of the 328,100 workforce in coalmines, mostly at privately run opencast mines, are contract workers. About 11 per cent of the 70,000 workforce in iron ore mines are contract workers, also in private opencast mines.

Contracting work out in South Africa's mines has traditionally been confined to non-core activities such as security, construction and shaft-sinking. In 1987 about 3 per cent of the gold mining workforce were contract workers. By 1998 this had risen to 10 per cent and contract work had been extended to underground workings too. In coalmines, the proportion of contract workers rose from 5 per cent to 16 per cent over the same period. In the gold mining sector, the increased recourse to contract work was due to the rapid fall in the price of gold in 1998. It was implemented as a means of reducing the cost of production and increasing flexibility. According to the National Union of Mineworkers (NUM), many of the workers who were retrenched in 1998 in the aftermath of the fall in the price of gold returned as contract workers – some in the same jobs as before but under inferior conditions of employment.[8]

In 1995 the NUM reached an agreement with the Chamber of Mines of South Africa on information sharing on subcontracting. While the agreement does not spell out which jobs can be subcontracted, it does restrict the practice to specialized works.

A report which concluded that there should be an investigation into the extent and impact of subcontracting in the South African gold industry alleged that:

- Contract workers are discouraged from joining unions and there is often tension between contract workers and unionized regular workers.
- Nearly two-thirds of contract workers are retrenched, experienced workers. But inexperienced or foreign workers have fewer expectations with respect to pay and working conditions.
- The proportion of contract workers who are foreign workers exceeds 30 per cent.
- Employment as a contract worker is unpredictable, irregular, insecure and unstable. There is acute uncertainty about retrenchment because of the lack of a severance package and notice.[9]

Figure 1.7 shows the proportion of contractors in the total mining workforce in seven countries in 1985-2000, ranging from 5 per cent to 35 per cent. In the United States the proportion of contract workers in non-coalmines increased from 17 per cent of the workforce in 1997 to 20.6 per cent in 2001. In coalmines, contract workers accounted for 30.6 per cent of the workforce in 2001, compared with 25.7 per cent in 1997.[10]

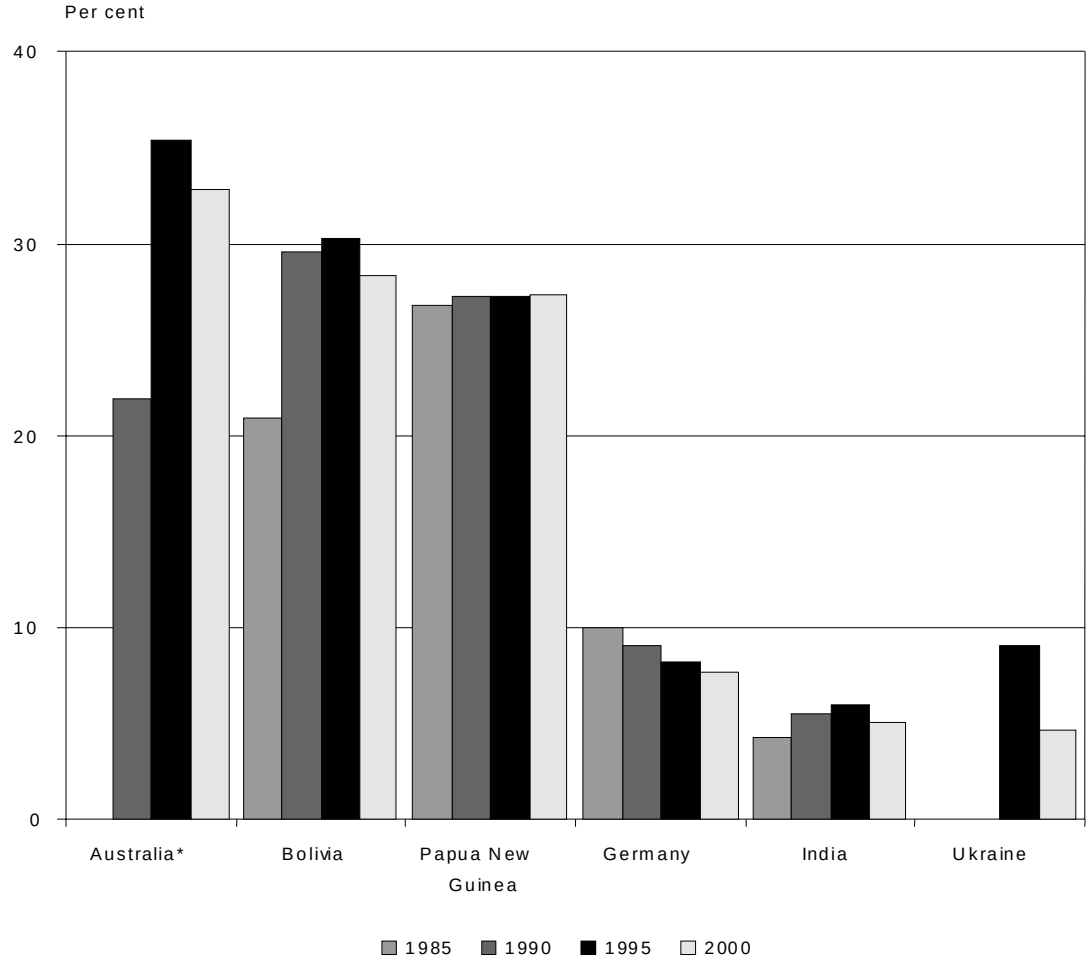
[7] *International Coal Report*, 4 Feb. 2002, p. 6.

[8] www.num.org.za, 15 Feb. 2002.

[9] Barry Streek: "Subcontracting explodes on mines", in *Weekly Mail and Guardian*, 1 Oct. 1999 (www.sn.apc.org/wmail/issues/991001/NEWS63.html).

[10] Peelish, op. cit.

Figure 1.7. Contract workers in the mining industry, 1985-2000: Selected countries (percentage of the workforce)



* Non-coal mines.

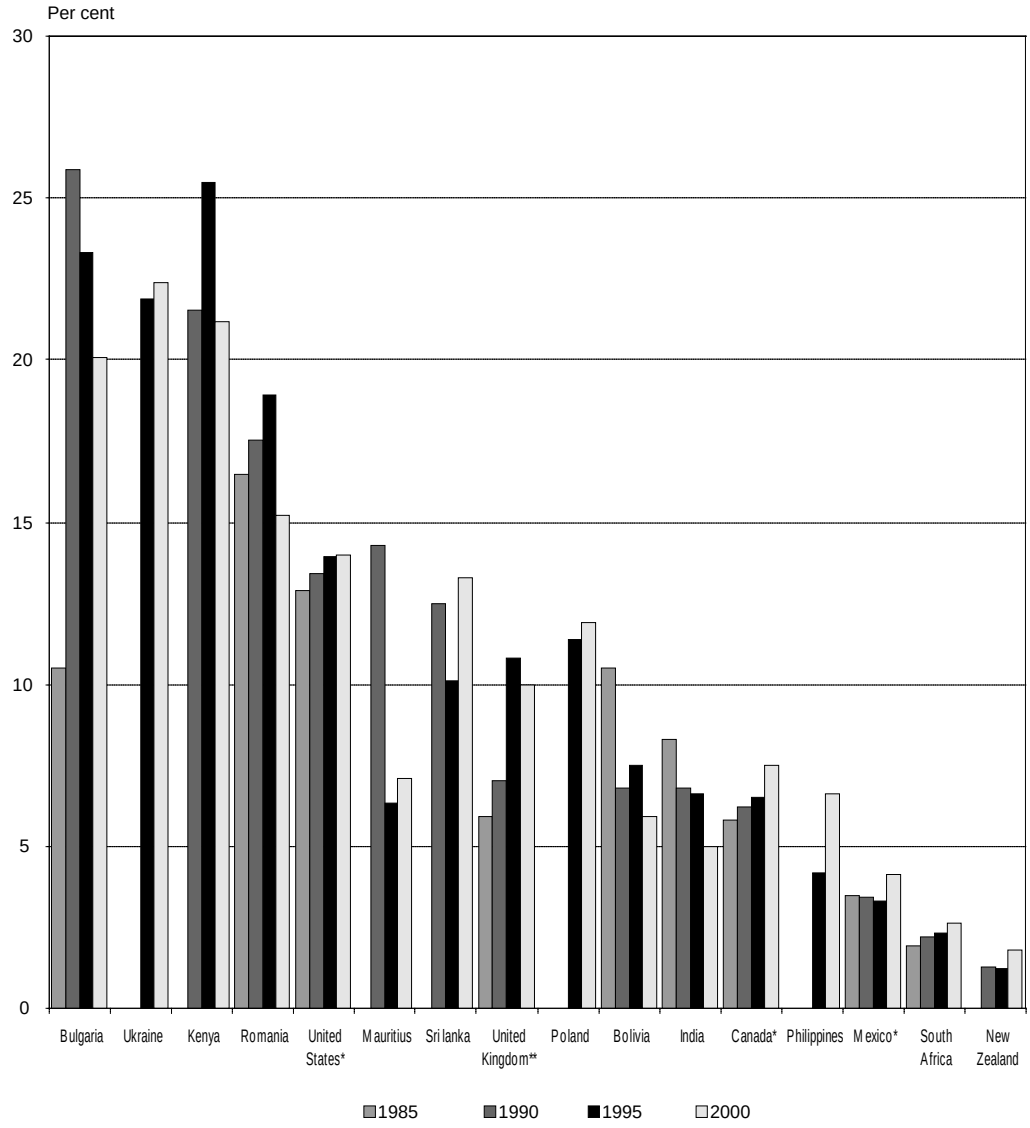
Source: Responses to ILO questionnaire.

The use of contract workers has implications for both training – particularly safety and health training – and working time in the light of the distancing of the relationship between the principal employer and the contract worker in the mine, but not for the principal employer's duty of care and responsibilities towards all the workforce.

Women in mining

Mining remains a male-dominated industry, perhaps for good reason. The proportion of women in the workforce in a sample of 15 countries varies from about 1 per cent to 25 per cent (figure 1.8). Female employment is typically below 10 per cent and has changed little in the 15 years between 1985 and 2000.

Figure 1.8. Female employment in mining, 1985-2000: Selected countries (percentage of the workforce)



* Canada, Mexico latest year = 1999; Romania, Ukraine, United States = 2001. ** Metal and non-metal mining.

Source: Responses to ILO questionnaire.

In most countries and companies the average remuneration of women in mining is below that of men; the representation of women in senior management positions is less than that of men; and the average turnover of female employees in mining is higher than that of males. However, this situation is no different from that in many other economic sectors, public and private, in many countries. But increasing numbers of mining companies are taking measures – either voluntarily or as a result of legislation – to counter these imbalances. Measures include policy development, training, development, and research initiatives to identify the underlying causes. Mining companies are increasingly developing and implementing equal opportunity policies and some have affirmative action policies. In Australia, for example, companies are required to report annually on equal opportunities for women in the workplace.[11]

[11] BHP Billiton: *Health, safety, environment and community report 2001*, p. 25.

The 65,600 women in the coalmining sector in Ukraine in 2001 accounted for 20 per cent of the workforce – well above the average. The proportion of women mineworkers has been at the same level for several years, notwithstanding the loss of 40 per cent of women's jobs since 1995. One-third of women working in underground coal production reportedly do so in poor working conditions as far as exposure to dust, heat and noise is concerned.[12]

In Australia, where about 10 per cent of the workforce are women, the proportion started to decline with the introduction of longer working hours and compressed shifts which tend to have a disproportionate effect on women because of their family responsibilities.

Social dialogue and employment

Social dialogue should be an effective means for addressing specific issues that are encompassed in the term "employment". These include recruitment, retrenchment, contract work and equal opportunity. Despite some well-publicized industrial disputes on employment issues, the trend towards dialogue and negotiation appears to be strengthening. This is hardly surprising as the mining industry comes to depend more on fewer workers. There may well be scope for capacity building or exchanges of information and experience to assist the social partners in being more effective in addressing employment issues, such as those in the following examples.

There have been recent news reports of industrial unrest in China following the closure of state-owned mines and other industries.[13] The protests have largely related to the late or non-payment of severance and pension benefits. In this context, it is appropriate to note that the United Nations Development Programme (UNDP) is to provide $730,000 for the All China Federation of Trade Unions to strengthen its role in protecting the interests and rights of Chinese workers. A four-year project will be carried out in close cooperation with the ILO.[14]

The extent of negotiation between employers and workers' representatives varies when contracting work out is under consideration. The fact that there tends to be less contracting out in Australian coalmines than in other mines (although the gap is closing) might be partly due to the higher level of unionization in the former and therefore more extensive negotiation. Or it could be due to the nature of much of the coalmining industry, especially in underground mines.

In South Africa, in response to the loss of 95,000 jobs in the gold industry in 1997-98, a tripartite gold mining summit agreed to adapt the retrenchment process to ensure proper consideration of alternatives to retrenchment. This process of social dialogue and information exchange was instrumental in alleviating distrust between the social partners and led mines to consider alternatives to retrenchment early in the restructuring process.

[12] Petrova, op. cit.

[13] *International Herald Tribune* (www.iht.com), 15 Apr. 2002.

[14] *China People's Daily* (http.//English.peopledaily.com.cn), 30 Mar. 2002.

2. Evolution of working time

Working time has different connotations depending on the perspective. From the point of view of productivity, it is one of the institutional factors that controls working activity. From an occupational perspective, hours of work can be viewed as the ratio between the number of hours required for production and the number of workers involved. From an individual viewpoint, hours of work is often the main factor influencing daily activities, even outside the workplace. And from the social point of view, hours of work largely influences the organization and enjoyment of social times, both in a positive and negative way.[1]

There are good reasons for the mining industry to be concerned about working time, in both qualitative and quantitative terms. Inappropriate schedules, excessive working hours, overtime and lack of training cause employee fatigue and human error. The resulting severe economic and social consequences include reduced productivity, higher accident and occupational disease rates, absenteeism, resignations and increased workers' compensation. On the other hand, there are considerable commercial, financial and industrial relations benefits to be realized from the development and successful implementation of effective working-time arrangements.

The combination of long working days and long working weeks, extended either through asymmetric compressed shifts or through extensive additional overtime, has the potential to introduce fatigue-related health and safety hazards. There is now sufficient evidence to suggest the strong probability of a relationship between fatigue-related performance impairment and increased risk of errors, incidents and accidents. As the clear trend is towards more mine sites adopting 12-hour shift arrangements, the development of strategies to address potential hazards so that they can be overcome is becoming more urgent.

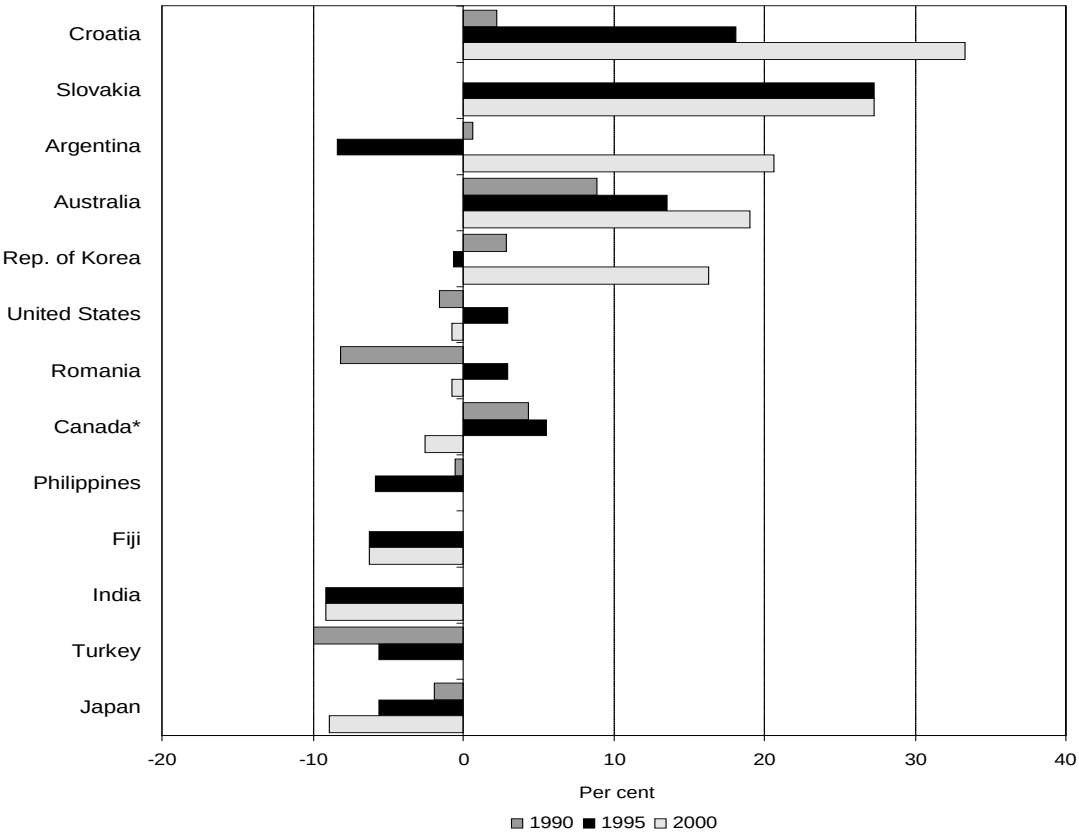
The extent to which employees feel overworked has implications in four areas of immediate concern to employers: safety in the workplace; job performance; employee retention; and health-care costs. These can have a significant impact on a mine's performance and on the health and safety of the workforce. But these issues are still not fully understood. Despite considerable research over the years, the very specific nature of each mining operation means that broad findings can rarely be applied. They might establish principles and even give some guidance, but equally they might be misleading at a given site.

Working time

Figures 2.1-2.5 illustrate changes in working time since 1985 and in the amount of time worked – per week or per year – for different types of mine in selected countries, based on answers to the questionnaire. There is a wide range of outcomes over the 15-year period, from considerable reductions in average working time to significant increases. Several countries that reported no change in working time over the period are not included.

[1] Alexander Wedderburn (ed.): "Statistics and news", in *Bulletin of European Studies on Time* (Dublin, European Foundation for the Improvement of Living and Working Conditions), No. 9, 1996.

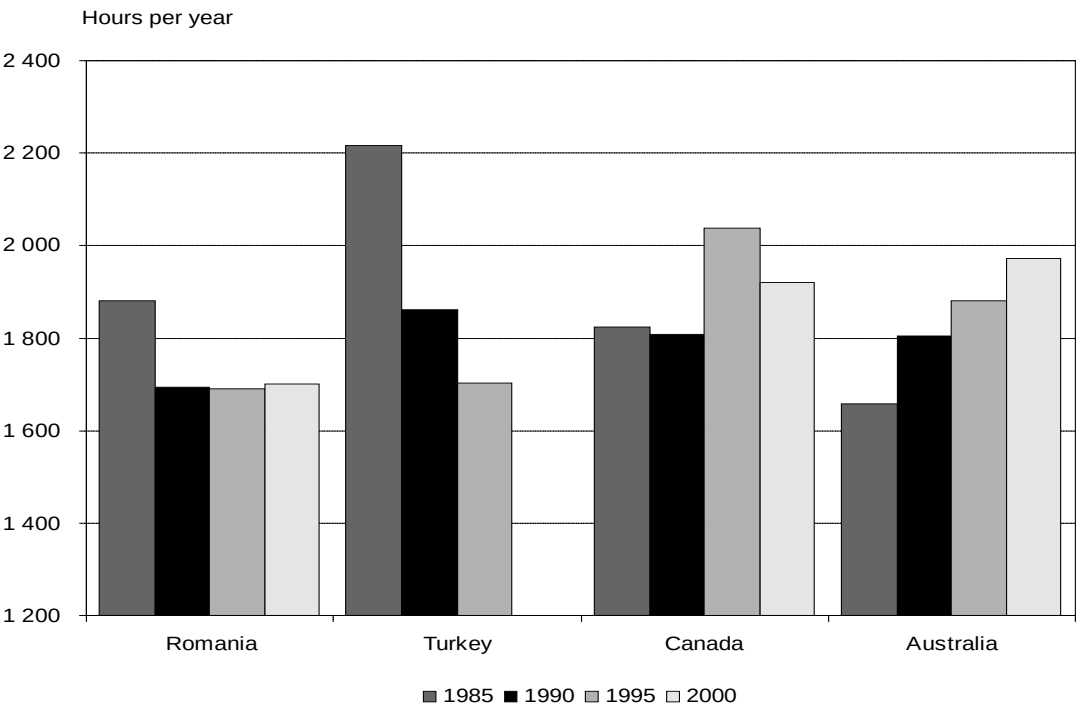
Figure 2.1. Evolution of working time in the mining sector, 1985-2000: Selected countries (percentage change over 1985)



* 1999.

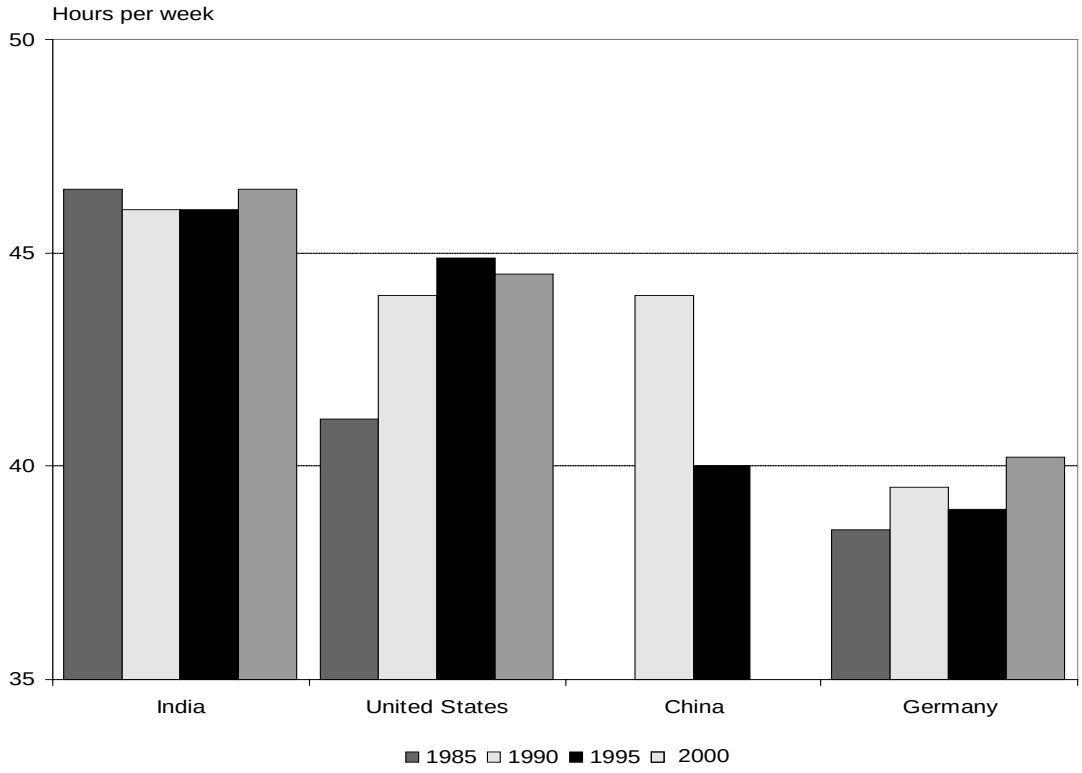
Source: Responses to ILO questionnaire.

Figure 2.2. Average annual working time in coalmines, 1985-2000: Selected countries



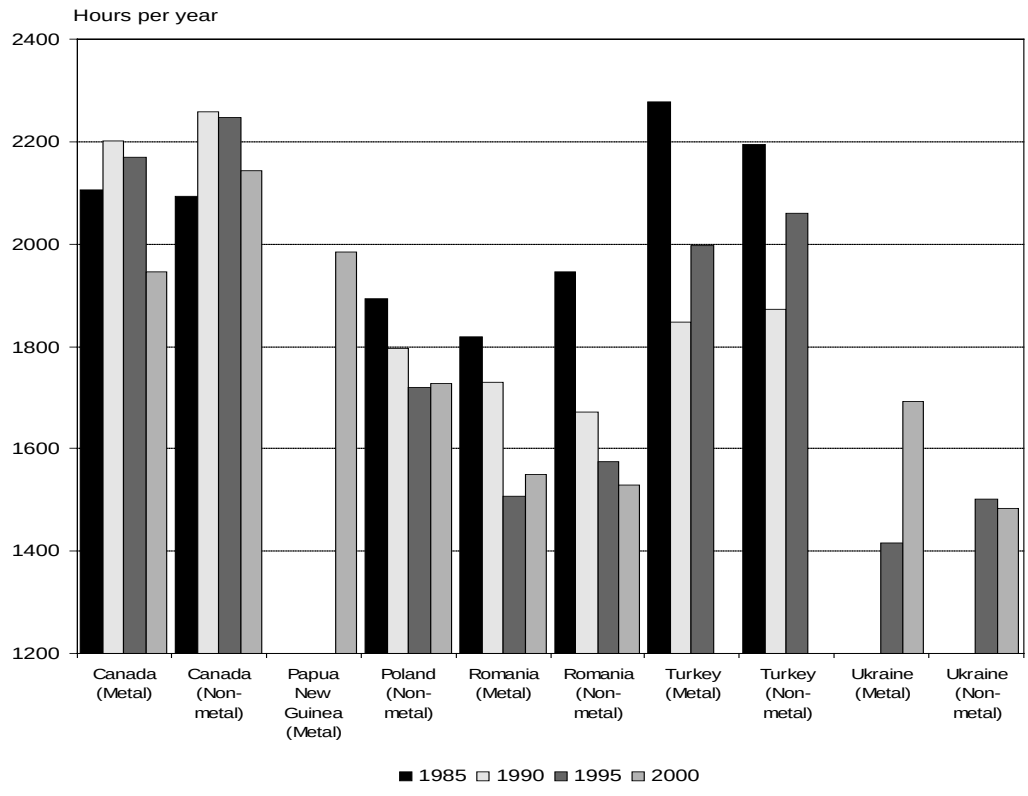
Source: ibid.

Figure 2.3. Average weekly working time in coalmines, 1985-2000: Selected countries



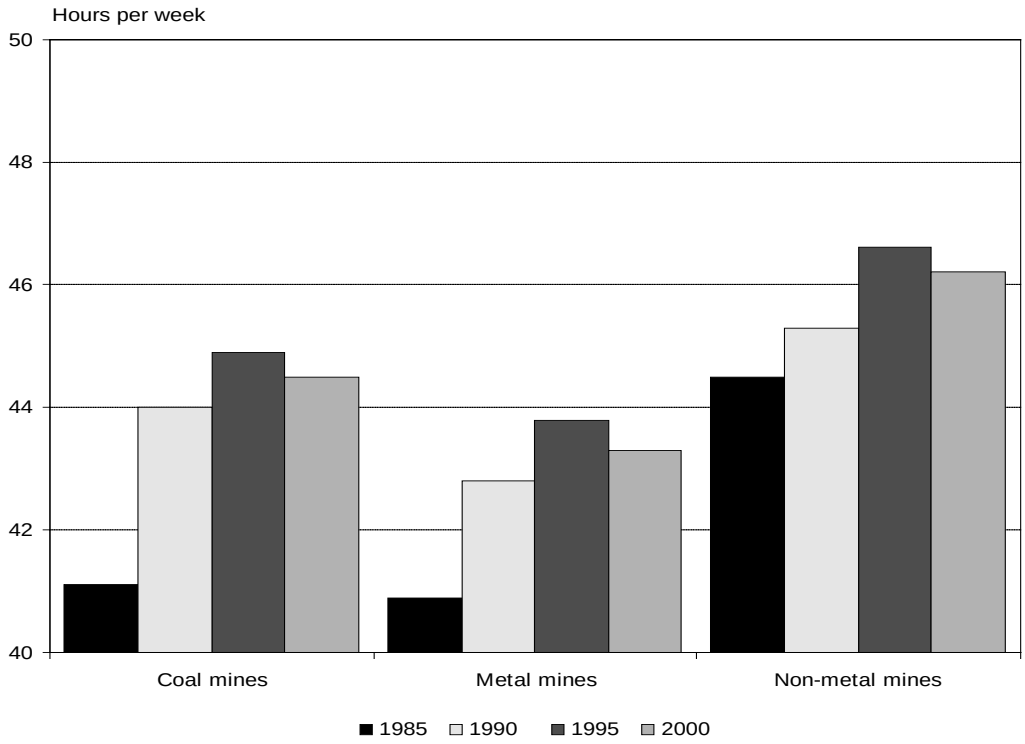
Source: ibid.

Figure 2.4. Average annual working time in metal and non-metal mines, 1985-2000: Selected countries



Source: ibid.

Figure 2.5. Average weekly working time in United States mines, 1985-2000



Source: ibid.

Based on this very limited sample, it appears that fewer hours are typically worked in coalmines than in metal and non-metal mines. In each category, the number of hours worked in underground mines tends to be less than in open-cut mines. Also, the further the workplace is from the surface, the less time is spent on production.

As far as overtime is concerned, the limited responses to the questionnaire were inconclusive. Some countries did report small amounts of regular overtime in both coal and non-coalmines (averaging about two hours a week), typically up to eight hours (one shift) a week, less in coalmines. In some cases, however, what might have been overtime in the past has been absorbed into standard hours of work in new more flexible working arrangements. But as can be seen from the two examples that follow, overtime – often regular, sometimes in considerable amounts, sometimes unpaid – is worked in many mines. These examples of the evolution of working time in the Australian and South African mining industries, are followed by a discussion on shift work that addresses fatigue and safety and health, and on industrial relations issues concerning hours of work.

Working time in Australian mines [2]

Between 1988 and 1998, the proportion of people in Australia who worked a standard week (35-44 hours) fell from 42 per cent to 35 per cent, whereas the proportion working 45 hours or more a week increased from 24 per cent to 27 per cent, more so in the mining

[2] This section and some other general sections in this chapter are drawn from Kathryn Heiler, Richard Pickersgill and Chris Briggs: *Working time arrangements in the Australian mining industry: Trends and implications with particular reference to occupational health and safety*, Sectoral Activities Programme Working Paper, No. 162 (Geneva, ILO, 2000).

industry. Over this period the mining industry experienced the largest shift towards long hours of work (over 60 per week) with 24 per cent of those employed working such hours.

Not surprisingly, the community setting of the mine influences the type and times of operation. Over 60 per cent of Australian mines are located in a settled mixed community, with 16 per cent in relatively isolated mining towns and a further 22 per cent being fly-in/fly-out operations. Almost all the mines that operate less than seven days a week or less than 24 hours a day are in settled communities.

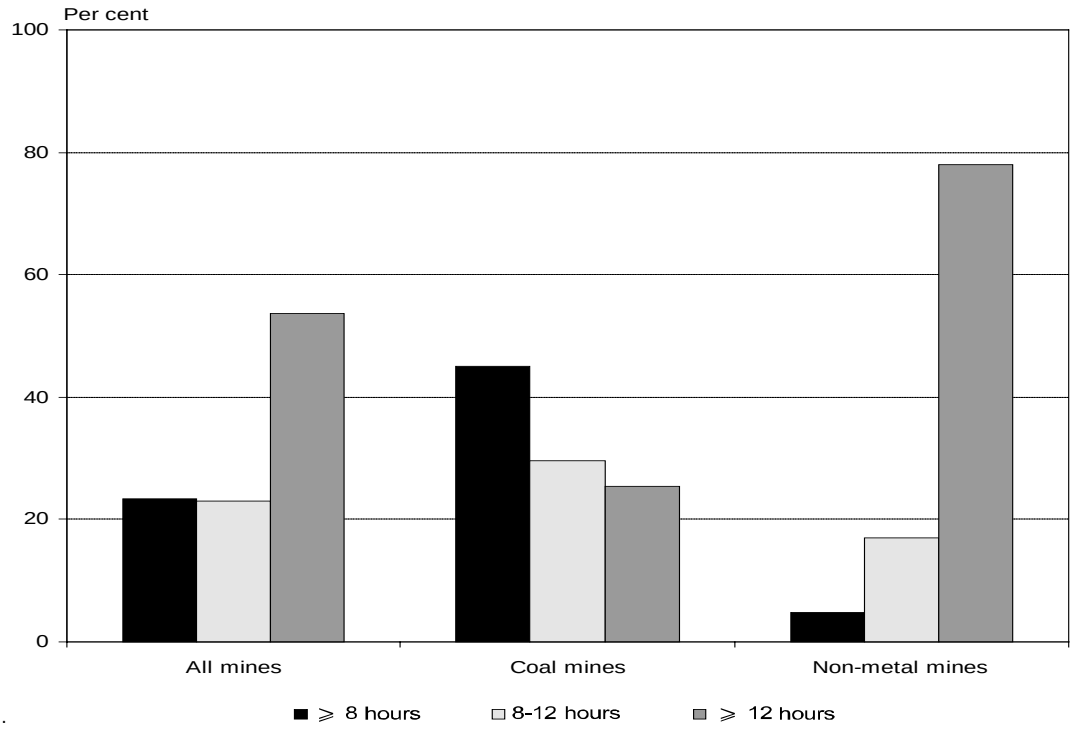
In 1995 about one-third of mining enterprises in Australia had some or all employees working 12-hour shifts. By 2000, this figure had risen to over 50 per cent (over 70 per cent in metal mines). There has also been an increase in average weekly working hours, which totalled 51.7 in 1998, compared with 46 in 1983.

In 2000, 70 per cent of Australian mines worked seven days a week, ranging from 93 per cent in Western Australia to 75 per cent in Queensland and 38 per cent in New South Wales, with coalmines far less likely to work in this way (60 per cent). As far as daily hours of operation are concerned, 86 per cent of all mines operate 24 hours a day (77 per cent of coalmines). Significantly, continuous daily operation does not necessarily mean operating seven days a week.

Shift lengths and patterns

Over 50 per cent of mines in Australia work 12-hour shifts in production areas (figure 2.6), although 12-hour maintenance work is less likely (45 per cent). But there are significant variations – from 93 per cent in one state (Western Australia) to 16 per cent in New South Wales where the coal sector tends to work on a less than 12-hour basis. Surface mines are twice as likely as underground mines to have a 12-hour work pattern.

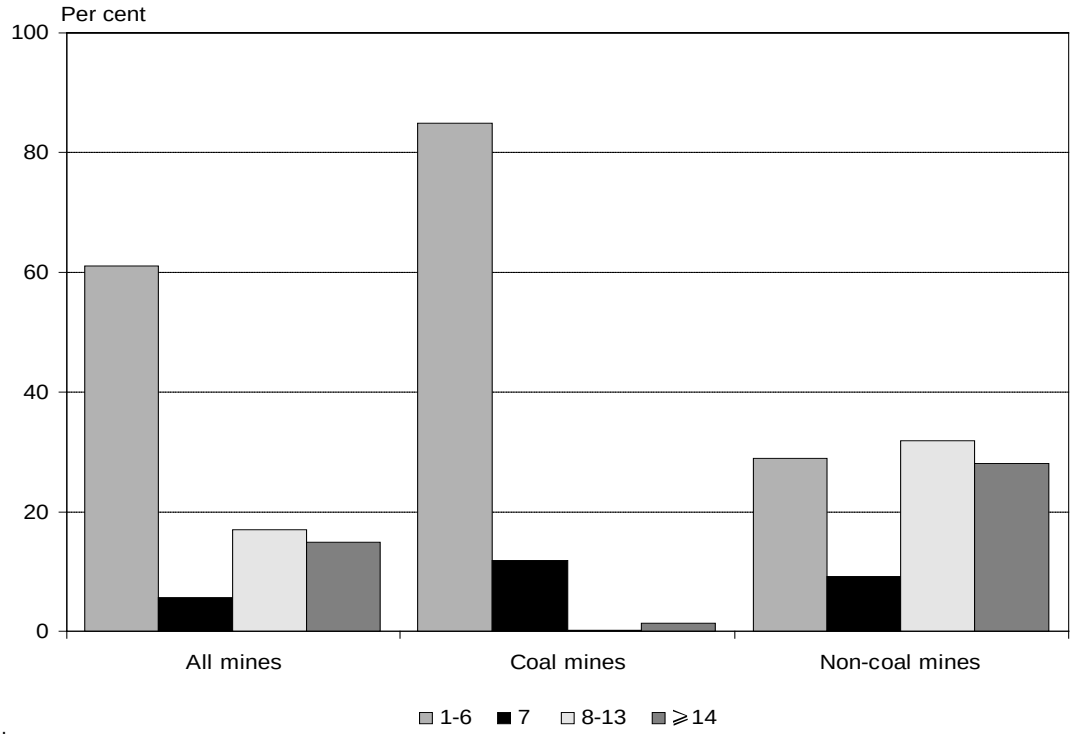
Figure 2.6. Australia: Shift length in mineral production



Source: Heiler, Pickersgill and Briggs, op. cit.

Only at 1-2 per cent of coalmines do workers work more than seven shifts in a row (most work five or six). In the non-coal sector, however, 60 per cent of mines have rosters of more than seven shifts in a row, including 28 per cent with more than 13 consecutive shifts (34 per cent in Western Australia where 93 per cent of sites work 12-hour shifts) (figure 2.7).

Figure 2.7. Australia: Consecutive shifts in mineral production



Source: ibid.

Over 60 per cent of Australian mines have average ordinary hours of work of over 40 per week, with one-third having over 49 hours a week (again, rarely in coalmines). Longer average ordinary hours of work are associated with 12-hour shifts. In principle, there should be no difference between the average weekly hours of work at 12-hour shift sites compared with any other arrangement because 12-hour shifts are meant to be worked in a compressed regime. But this is not always the case. At half the 12-hour sites ordinary working hours exceeded 49 per week, compared with 31 per cent of all sites.

About 70 per cent of production and maintenance workers in Australian mines work overtime that is in addition to any mandatory overtime absorbed into standard working hours as a result of an agreement (30 per cent on a regular basis, mostly less than eight hours a week). Those who work overtime tend to work shifts of less than 12 hours, especially in the coal industry where hourly wages are lower than in the non-coal sector and employees are compensated separately for overtime worked.

One-third of production workers on 12-hour shifts do additional overtime by extending the shift or work additional shifts. This is significant since a key design principle of 12-hour shifts is that they should not be routinely extended by overtime.

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. It is, however,

acknowledged 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. Night shifts and the problems of sleep deficit are identified as specific problems that can disrupt workers' family and social lives. Box 2.1 gives a specific example.

Box 2.1. Long hours in an Australian mine

Five male miners and their female partners were interviewed as part of a study on working time carried out by the Universities of Sydney and Adelaide for the Australian Council of Trade Unions. The miners worked in an open-cut mine in a single town. They drove equipment, generally on 12-hour shifts. The most common shift pattern worked was two 12-hour days followed by two 12-hour nights and then four days off. Thus they worked 48 hours in an eight-day period of alternating night and day shifts. Some of them had worked other types of shift patterns. Several worked paid overtime. One worker sometimes worked an extra night shift, taking his hours in the eight-day period to 60. Overtime was paid. Some worked unpaid overtime, for example going to work 30 minutes early to "find out what is going on and become oriented for work".

Generally, this group of workers was only "doing it for the money". There was little sign of love for the job. Some who had taken on the occupation with the intention of leaving after a short period of time found themselves many years later approaching retirement in the same job.

Some of the workers believed that their children would leave the town as soon as they finished school, thereby limiting their time with them. Each worker and each partner agreed that they had missed out on "full fathering" in the sense that they had missed important events involving their children.

While some couples felt that their relationship would always come first ("we would leave if we felt it was a risk"), each recounted stories of marital break-up in the town and each saw a link between working time arrangements and the pressures on couples.

In each household, the woman parented and worked around her partner's hours, adopting a residual model of partnership where the full-time shift-working pattern of the male breadwinner dominated domestic life.

The impact of the mine's working arrangements affected the whole town. Close social contacts enabled one mother to move her children to a house where the father would not be sleeping after his night shift. But there were also downsides – for local clubs, sporting groups and the community. While fellow shiftworkers understood and shared the downsides of the eternal pursuit of a good sleep during the day, neighbours had fallen out as they lived with each other's noisy dogs, lawnmowers, children and boat engines.

With 12-hour day/night shifts, families and workers found changes in their rosters very unsettling. "Everybody is settled, then they go and change it. I don't know why they are like that, but it's every time. You know, a different roster and once everyone is happy with it, they change it again. It's been like that all the time."

Source: *Australian Mining*, 12 Feb. 2002 (www.miningaustralia.com.au).

Thus, the degree to which family units are affected by shift work depends on the stage at which the family is at in its life cycle, the responsibilities of the non-shiftworking partner, and the place of the family within the local community.

There is a two-way relationship between home life and work life. Worker stress that is generated by employment conditions can affect the physical and psychological health of cohabiting partners. Satisfaction with a shift schedule tends to be highest when workers are able to have time with family, children, friends and community. 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 whether 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.

Implications for local communities

There is less published work in Australia on the impact on local communities of changes to rosters and working-time arrangements than there is on family issues. This is true for both the impact of long-distance commuting (LDC) arrangements on families and local/regional communities and the impact of compressed and extended shifts on local settled communities. One exception explored the family and community impact of a change to seven-days-a-week operation, primarily from the perspective of women. As in the example above, the change had a detrimental effect on the relationships of employees with their children and partners. The change also had a negative effect on community social and sporting activities which relied on community members sharing common free time. At another mine, the introduction of compressed shifts led to many families relocating to coastal areas, with employees staying in the town only to work their shift and then travelling back to their families. This had an impact on local business, schools and support services in the town.

The work that has been carried out on the community impact of LDC arrangements on both families and regional communities highlights the following kinds of issues that need to be explored when LDC is contemplated:

- 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.

The ability to be fully involved in community activities can provide an important outlet for the stress and boredom of the job, and it allows families to spend more time together as a group. But participation in community life can be severely restricted by the requirements of a rigid rotating shift roster.

Boxes 2.2 and 2.3 give two perspectives – trade union and employer – on working time issues in Australia.

Box 2.2. Evolution of working time in the Australian coal industry:
A trade union perspective

Until the mid-1980s the standard working pattern in the Australian coal industry was five seven-hour shifts per week (Monday-Friday). From the mid-1980s the pattern became eight-hour shifts with three shifts per day. At the same time Saturday and often Sunday became working days. Operating six or seven days a week entailed having four or five complete crews or "panels". A "five-panel roster" enabled workers to have more free time on weekends but required more employees.

The last decade has seen a steady trend towards 12-hour shifts. Having only two shift changes per day means there is less disruption to production. The usual 12-hour shift pattern is usually that four shifts are worked in a row followed by two days off. But up to 21 days in a row might be worked. The result is a variety of average working hours. A person who works for four days followed by four days off will average 42 hours per week over a seven-week cycle, as does a person who works seven days followed by seven days off. But someone who works for 14 days followed by seven days off averages 56 hours per week over a six-week cycle. In some cases people work 12½ hour (or longer) shifts to enable "hot seat changeovers" so that production does not stop for more than a few minutes at the change of shift.

As there are few, if any, health and safety restrictions on working hours in the Australian mining industry, workers may agree to work any type of roster. Agreement to a certain roster is usually a condition of employment. Where the workforce is unionized, working hours and rosters are the subject of collective bargaining that often includes minimum periods of rest between shifts. Where unions do not exist on-site then the working hours may be entirely determined by management.

If workers live on site during working periods, travelling time and fatigue associated with it are reduced but it usually makes family and other social responsibilities more difficult. There is also the problem of extended travelling time at the beginning and end of the work period.

The cause of these changes in working time has been the perceived need by employers to cut production costs by increasing productivity to meet competitive pressure in international commodity markets, combined with the need to maintain profits. Because demand for most minerals is rising only slowly, producers usually cannot increase profits by increasing production. Even where production is increased, the margin of sales revenue over costs of production is often small. So the main way to increase returns is to cut production costs. Requiring workers to work longer hours is an obvious way to achieve this objective.

In the Australian black coalmining industry, changes in working time are usually implemented through consultation with the union. In the non-coal sector, which is mostly non-union, changes in working time have been introduced unilaterally by employers. Employers are not required to seek the approval of any government agency for changes in working hours. In many cases the introduction of change has been on a "trial and error" basis, with several roster changes implemented in a relatively short period of time as the mine management seeks to find the arrangement that best suits the operational needs of the mine.

While the strongest trend in new working arrangements is towards longer working hours per shift, there is a concurrent trend to work more hours per year (see above).

There is a surprising and disturbing lack of research on the health impact of longer working hours in Australian mining. There is also serious concern over the validity of lost-time injury data. Figures are affected by the extent to which injured workers are placed on light duties so they do not appear as a lost-time injury. The linking of bonuses to reductions in lost-time injuries can lead to workers not reporting some injuries.

A further issue is that lost-time injury frequency rate data fail to capture the way in which many workers deal with the fatigue and resulting health and safety risk from longer working hours: they resign. The high labour turnover in those sections of the mining industry with the longest working hours indicates that workers are choosing to manage fatigue by staying in the industry for a short period of time. Some rosters with very long hours – "young men's rosters" – are not considered sustainable for long-term employment.

The high incidence of 12-hour shifts in the non-coal sector will spread further to coalmining. It is possible that some mining companies will respond to community and government concern over working hours by reducing the number of consecutive shifts worked to seven or less. However this is unlikely in the absence of government regulation.

Legal action by workers injured as a result of fatigue arising from long working hours might induce some companies to develop better rosters and/or provide more justification in health and safety terms for their existing rosters. But workers' compensation law in Australia severely limits the capacity for workers to take legal action that will result in significant financial damages being awarded against companies. Further, most employees will prefer to cope with the pressure of fatigue by leaving the industry before they are injured.

Source: Construction, Forestry, Mining and Energy Union, Australia, unpublished study prepared for the ILO, 2002.

Box 2.3. Evolution of working time in the Australian mining industry: The employer perspective

The management of shift work is complex and is encompassed by the more generic issues of fitness for duty and responsible work design. In the Australian context, at least, the duty of care is the best way to address working time-issues.

In many cases the move away from traditional rosters to more flexible extended hours, compressed work-weeks and fly-in/fly-out operations has improved the off-work environment. Families can live where they want, children can attend the schools they want and the amount of quality time that can be spent together is increased.

Shift work encompasses not only hours of work, but how they are arranged. Equally important is what happens during hours not at work. The employer can influence the nature of hours of work but can do little to control the off-work behaviour of workers, other than through education and training. The behaviour of an individual outside the work environment, in particular the amount of rest obtained, plays a crucial part in the successful management of shift work and is the responsibility of each employee.

The issues associated with the potential social impact of working-time arrangements are complex and are often misrepresented as being solely health and safety issues.

Personal habits, including diet and lifestyle, directly affect the quality of rest that a person can achieve between shifts and between work cycles. These may not be related to the shift pattern. Providing education on this issue is in part an employer's duty of care. If an employee is also employed (in a second job) on his days off, the principles of rest that should be built into the shift work roster will be undermined.

While a second job might be financially rewarding, it can add considerably to the stress and fatigue factors at the primary job, not least because of having insufficient time to recuperate.

Different players might approach the choice of shift work pattern in ways that are not necessarily compatible with good design. Employees might prefer a less healthy backwards rotating roster to maximize time off. Employers might prefer a roster that minimizes costs. Roster design must be supported by the known health and safety parameters of the various alternatives. Further research is needed in the area of intensive work rosters in both fly-in/fly-out and daily commuting operations to define safe operating conditions.

No roster system will be effective in minimizing fatigue unless education and information on the management of sleep and fatigue are supplied to workers.

Effective management of work-related and non-work-related fatigue is likely to benefit enterprises, employees and their families and communities. Individuals can expect benefits to health, well-being, motivation and quality of life. Enterprises can expect improvements in morale, safety, productivity, absenteeism and turnover.

Hours-of-work arrangements in mining need careful management, through consultations and involvement of the workforce. Many factors have been identified as contributing to the potential adverse impact of hours of work. They require special attention, together with site-specific factors. The importance of site-specific factors reinforces the need for management and workers to exercise their duty-of-care responsibilities rather than relying on generic guidelines or regulations.

Source: Michael Pinnock and David Cliff: *Working time arrangements in the resources sector in the 21st century: The employer perspective,* speech to Queensland Mining Council, Brisbane, 8 Aug. 2001.

Working time in South African mines [3]

In South Africa, where working time is governed by legislation, there have been a number of changes in work organization, notably working time, in recent years. The traditional 11-shift fortnight has been largely replaced by the five-day week or by "full calendar operations (fulco)", with various shift arrangements having different impacts on

[3] This section draws on Peter Lewis and Trevor Wagner: *The effects of full calendar operations (fulco) and other non-standard work organizational features on underground injury frequency and severity in SA mines*, project No. GEN606 (Johannesburg, SIMRAC, Dec. 2000).

overtime. At the same time, there has been an increase in the use of subcontracted labour underground and in the payment of productivity-linked bonuses.

A pilot study to assess the effects of new work organization on the frequency and severity of accidents in underground mines examined a range of data over ten years (1990-2000). The difficulties in collecting adequate and consistent data meant that it was not always possible to draw statistically significant conclusions. Nonetheless, the following are relevant at the mines concerned:

- the higher the average monthly bonus paid per permanent employee, the lower the reportable injury rate;
- the reportable injury rate was closely linked to the ratio of actual to target output for the productivity bonus system;
- the introduction of 18x4 shifts was linked to an improvement in reportable injury rates;
- average weekly overtime worked was associated with the fatal injury rate.

Non-continuous working-time arrangements in South African mines remain varied. They include a standard five-day week (Monday to Friday), some with 12-hour shifts; an 11-shift fortnight, a 6x1:6x1:5x2 schedule (which implies considerable compulsory paid overtime); and a 4x4 schedule with 12-hour shifts. Fulco operations are also varied, with some mines having different schedules for production, engineering and maintenance. Schedules for continuous operations include: 18x4; 22x3, 4x4; 10x4; 7-1, 7-1, 7-5; 11x3.

The 11-shift fortnight was introduced in South African mines in 1977. It allows production workers one Saturday off every two weeks. The inquiry which led to this change to a six-day week also recommended that the industry consider moving to a five-day working week in a seven-day mine week on a roster basis. In other words, a shorter working week for each worker, but continuous operation for the mine. The 1990s saw a strong move towards continuous operations. The social partners agreed that fulco shift schedules would be negotiated at the mine level. This has led to the wide variety of rotating shift schedules (see above). At the same time, as a result of the Basic Conditions of Employment Act of 1997, many mines have instituted a five-day 45-hour standard working week (Monday to Friday) with overtime shifts solely to make up for any production lost during the week.

Shift schedules, fulco or not, are moving towards a standard 45-hour week. Some of the shift schedules that are used – and they are implemented as a means to reduce unit labour costs and increase output – entail the working of substantial overtime if the provisions of the Act that limit working time are to be met.

In recognition of the complex impact of continuous work on employees, a review of the interaction between shift work and health and safety recommended that a uniform system for working-time arrangements for continuous mining that is in line with international standards be adopted, based on full participation, drawing on national and international experience. Moreover, it should not exclude monitoring of the efficiency of implemented schedules.

The problem is, there are no international standards. Moreover, the collection of relevant, reliable data to make comparisons between existing and new systems is onerous. What will work at one site could be completely unacceptable elsewhere. Regulations on working time, if they exist, place additional constraints on flexibility. Clearly, minimizing changeover times by having two shifts instead of three, or having “hot seat” changeovers is

important, nowhere more so than in South African mines that are 2 km or more deep before the journey to the workplace starts.

Working time and shift work

The elements of working time – how many hours are worked each shift; how many shifts are worked at a time; how many hours are worked in a given period and how much time off is allowed; and how much overtime is worked – combine in an almost infinite array of options, rosters, or rotas that make it difficult to generalize. What happens outside hours of work is also part of the equation.

In some countries working time is governed by legislation, elsewhere it has become a matter for negotiation, often at the site level, between the social partners under the umbrella of a duty of care established by the regulatory authority.

Australia, Canada and the United States, among countries with a substantial mining sector, have no statutory limitations on hours of work, shift work or the working day. Moreover, having a self-regulatory approach towards occupational safety and health means that those responsible for creating risks – employers – and those who work with these risks – employees – should cooperate in the workplace to eliminate or manage them. And this includes working time. Nonetheless, systems of industry-wide agreements and some legislation have acted as de facto enforceable industrial standards governing working time. Since the early 1990s there has been a move away from the standard working time model towards an increasingly fragmented and diversified one. This is illustrated in the study carried out in Australia which is drawn on extensively throughout this chapter. [4] It is here that the mining industry has experienced the largest proportional transition to long hours of work and, as of 2000, mining had the largest proportion of its workforce working over 60 hours a week.

But shift length is only one factor of shift work. The way and extent to which the shifts are compressed or extended are important components of working time arrangements, including for health and safety and family life. Table 2.1 contains some of the potential advantages and disadvantages of working compressed shifts where standard hours are worked in a shorter than average time. However, compressed working time does not include extended working time resulting from overtime.

[4] Heiler, Pickersgill and Briggs, op. cit.

Table 2.1. Potential advantages and disadvantages of compressed shifts

Potential advantages	Potential disadvantages
Reduction in commuting problems and costs	Decline in job performance due to "moonlighting"
Fewer workdays with no loss of pay	Increased commuting costs
Regular, steady work-week	Overtime pay required by law
Ease in covering all jobs at the required times	More fatigued workers
More time for scheduling meetings or training sessions	Little recognition of employees' individual differences
Increased opportunity for internal communication	Increased tardiness
Increased opportunity for external communication	Increased absenteeism
Decrease in start-up/warm-up expenses	Increased employee turnover
Fewer supervisory personnel needed	Increases in on-the-job and off-the-job accidents
Less night work	Reduced production rates
Increased production	Increased exposure to toxic substances and/or physical agents
Better opportunities to hire skilled workers in tight labour markets	Scheduling problems if organizational operations are longer than the work-week
Increased off-the-job time	Contrary to traditional objectives of trade unions
Improved choice for workers concerning working time	Increased energy and physical maintenance costs
Decreased lost-time injury frequency rates	Greater administrative and training costs
Closer matching of staffing levels and hours to operational requirements	Longer workday
More efficient production flow	Cumulative fatigue across fewer days
Improved employee morale	Loss of sleep

Sources: Alexander Wedderburn (ed.).: "Compressed working time", in *Bulletin of European Studies on Time* (Dublin, European Foundation for the Improvement of Living and Working Conditions), No. 10, 1996.
James C. Duchon and Thomas J. Smith: "Extended workdays in mining and other industries: A review of the literature", in *Bureau of Mines Information Circular,* No. 9378 (Washington, DC, United States Department of the Interior, 1994).

Shift work design

There is more to the shift work issue than arguments about 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 to manage these arrangements proactively and minimize risks associated with them. Focusing the debate on trying to prove the inferiority or superiority of one shift system over another contributes little to understanding the real hazards, some known and some unknown, associated with shift work.

The risks associated with shift rosters are multifaceted and complex and cannot be dismissed (or confirmed) on the basis of limited and inadequate data. Greater caution is required and a more sophisticated understanding must be applied. There will inevitably be specific hazards associated with compressed schedules, just as there will 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. The combination of extended days and extended weekly hours is very much uncharted waters in terms of fatigue and safety effects, especially within a mining environment. For example, the need for extra biological and social 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 preparation and recuperation due to extended workdays, or which have long periods of compression in arduous or difficult environments (such as hot, humid underground environments), are problematic. In addition to considering the workload and the working environment, conditions outside the place of work, including commuting and the way that long periods of leisure time are used must also be taken into account.

Work organization based on teams and multiskilling promises to increase both the range of skills workers use and their control over their work. This is not always the case, especially when workers are not replaced. The result can be increased stress and fatigue. [5]

Commuting time is very important when 12-hour shifts (and overtime) are considered. Where commuting involves over an hour of driving, it is hardly part of a shiftworker's recreation time. There are plenty of mineworkers, in the United States for example, who after being retrenched from one mine found employment at another 150 km or more away. Since it was impossible to relocate for financial or family reasons, they face two or more hours of travel twice a day.

Older work schedules that were originally designed for a workforce of a different age group, or for out-of-date technology could be inappropriate – for example for younger workers with family responsibilities – or dangerous if new technologies change the mental and physical demands placed on a worker. Notwithstanding the difficulty in establishing a cause-effect relation between shift work and long-run harmful effects, it is prudent to adopt shift patterns that minimize the long-lasting disruption of circadian rhythms, taking into account that in most mining enterprises the workforce is overwhelmingly male, employed on a full-time basis and older than the national average. A well-designed schedule will suit both the enterprise and the workforce (box 2.4). But changing a work schedule needs great care and the involvement of management and workers, plus specialists in ergonomics and human factors in its design, monitoring and evaluation. If possible, a trial period should be agreed and implemented.

[5] ILO: *Encyclopaedia of Occupational Health and Safety*, Vol. 1, Ch. 24 (Geneva, 1998).

Box 2.4. Recommendations for the design of shift systems

- Night work should be reduced as much as possible. If this is not possible, quickly rotating systems are preferable to slowly rotating ones. Permanent night work does not seem to be advisable for the majority of shiftworkers.
- Extended workdays (9-12 hours) should be contemplated only if:
  - the nature of work and the workload are suitable;
  - the shift system is designed to minimize the accumulation of fatigue;
  - there are adequate arrangements to ensure that a complete recovery after work and a high acceptance of the working-time arrangement are possible.
- An early start for the morning shift should be avoided. In all shift systems, flexible working-time arrangements are realizable. The highest flexibility is possible in "time autonomous groups".
- Quick changeovers (e.g. from night to afternoon shift on the same day or from afternoon to morning shift) must be avoided. The number of consecutive working days should be limited to five to seven days. Every shift system should include some free weekends with at least two full successive days off.
- The forward rotation of shifts (morning, afternoon, night) would seem to be recommendable, at least in continuous shift systems.

Source: *Encyclopaedia of Occupational Health and Safety*, Vol. 2, Ch. 43 (Geneva, 1998).

If, when shifts are designed, insufficient account is taken of the strong relationship between job satisfaction and life satisfaction and the ways that they impact on each other, particularly in remote communities, the consequences are likely to be severe.

The impact of working time on time away from work should not be treated merely as a side effect of working. There is therefore a need to look at this impact when shifts are being designed. At least one survey indicates that this is not the case. All the sites identified family problems arising from the roster system, particularly as far as organizing family and personal commitments was concerned. Only 12 per cent had roster systems that enabled workers frequently to meet these commitments. [6]

There is a plethora of lists of do's and don'ts as far as establishing working-time schedules is concerned. Much depends on the extent to which working time is regulated. The move towards self-regulation of occupational safety and health has placed responsibility squarely on the employers and workers concerned. The joint responsibility needs to be appreciated if the industry is to function properly and employers and workers need to cooperate at all stages, including addressing the effects of shift work in all its forms.

The guidelines produced by the Western Australian mining industry [7] address a range of issues in the context of the responsibilities of employers and workers arising from the duty of care. These include: the effects of shift work on health, family and work performance; roster design; health-care management; and exposure standards. As far as the

[6] Tony Maher: *Understanding and managing the safety hazards of shiftwork and extended working hours,* paper submitted to the Second IQPC Conference on Best Practice Rostering and Shiftwork, Sydney, 20-21 June 2001.

[7] Chamber of Minerals and Energy of Western Australia: *Shiftwork and occupational health and safety in the Western Australian mining industry: Guidelines for workers and management* (Perth, 1998).

latter is concerned, a government guideline was published in 1999.[8] It includes recommended exposure reduction factors for different standards. The guideline points out that there is a scientific consensus that people working unusual or extended work shifts should be provided with at least an equivalent degree of protection to that afforded to people who work conventional shifts. However, there is no consensus on a universal exposure standard adjustment regime.

Working time and an ageing workforce

In many countries the average age of mineworkers is well above that of other industrial workers. What difference does this make as far as working time is concerned?

The former United States Bureau of Mines conducted a study in 1994 to see to what extent workers of different ages were affected by a change from eight-hour to 12-hour shifts.[9] The average age of miners in the United States is increasing. Over 50 per cent of mines were over 45 years of age in 2001; many are working fewer but longer days. It was already well-established that older shift workers tended to have more health problems, more sleep complaints and showed reduced performance. But some studies show that older workers are involved in fewer accidents than younger ones. If this were the case for eight-hour shifts, what would happen on 12-hour shifts?

The group of 25 underground shiftworkers in the study (with mean ages of 26.5 and 49.6 years) changed from a 7x2 (seven days at work; two days off), eight-hour shift schedule to a 4x4, 12-hour schedule. Data collected for both schedules consisted of subjective, psychomotor and physiological measures. The results indicate that worker age influences all three types of measures for both schedules. However, these age-difference effects did not appear to be more pronounced on the 12-hour relative to the eight-hour schedule. Based on this study, although it is of small size and the fact that performance in tests might not correspond fully to performance on the job, it can be argued that differences in the level of fatigue between older and younger shiftworkers are not affected by the length of the shift.

A second part of the study looked at change in behaviour, physiological performance and fatigue as a result of the change.[10] The outcome suggested that the extended workday schedule should be retained since the 12-hour schedule was overwhelmingly supported by the workforce and there was a positive impact on absenteeism, morale, eating habits, family life and sleep quantity and quality. Extended shifts were not associated with decreased performance, and physiological measures did not show indicators of additional fatigue. However, the fact that the workers lived at the mine during the trial probably influenced the results as far as sleep and its benefits were concerned.

[8] Department of Minerals and Energy of Western Australia: *Adjustment of exposure standards for extended workshifts: Guidelines* (Perth, 1999).

[9] Christopher M. Keran; James C. Duchon; Thomas J. Smith: "Older workers and longer days: Are they compatible", in *International Journal of Industrial Ergonomics*, 13 (New York, Elsevier, 1994), pp. 113-123.

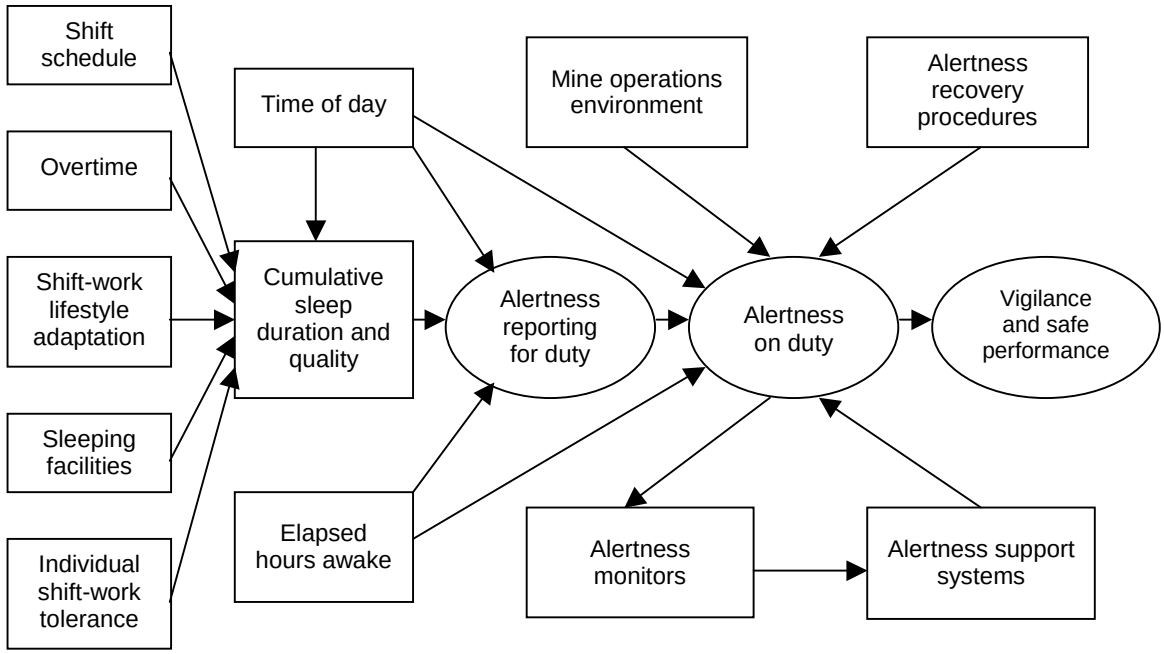
[10] James C. Duchon; Christopher M. Keran; Thomas J. Smith: "Extended workdays in an underground mine: A performance analysis", in *Human Factors* (Santa Monica), 36(2), 1994, pp. 258-268.

There is a clear need, whenever a new shift system is introduced, to monitor and evaluate it based on a range of criteria that includes input from workers about the schedule as well as the monitoring of absenteeism, safety and productivity.

Working time and 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 (figure 2.8).

Figure 2.8. Determinants of alertness and performance in the shiftworker's environment



Source: William Sirois: "Managing the human consequences of 24-hour mining operations", paper presented at Minesafe International 2000, Perth, Western Australia, 3-8 September 2000.

Provided the causes of work-related and non-work-related fatigue can be identified, the respective responsibilities of employers and workers can be addressed. Non-work-related fatigue is a product of home and family circumstances, non-work activities, and lifestyle, health and strategies for coping with shift arrangements. Work-related fatigue is a product of both physical and 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 occur, 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

Performance impairment due to fatigue 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 is likely to suffer.

In a mining environment, where heavy (and expensive) plant and equipment can be under the control of a single operator for extended periods, fatigue poses 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. The following kinds of fatigue-related problems can emerge:

- 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 when circadian rhythms are at their low 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 in 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.

Fortunately, there is growing recognition of the need to manage more actively the effects of fatigue at the workplace level. In three states in Australia – Western Australia, Queensland and New South Wales – 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 Western Australia this has taken the form of a code of practice; in Queensland fitness for duty with respect to fatigue has been included in recent mining legislation dealing with safety and health; while in New South Wales it has been recently inserted in regulations on mine inspection 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 also require that hazards associated with work systems are managed.

There are, however, a number of implications associated with confining fatigue management in mining within a narrow "fitness for duty" framework. [11] 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.

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 underdeveloped in the mining industry. 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 are an issue that currently confronts many sites. A risk-management approach alone may struggle to control adequately the risks associated with some very long and intensive work schedules. [12]

Moreover, although much of the recent emphasis has been on fitness for work and performance, 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, at least 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.

Dealing with fatigue

The number of consecutive hours on duty is not the best predictor of dangerous levels of fatigue, nor does the number of consecutive hours of available rest time ensure alertness. Alertness is a physiological problem that is mainly treated as a behavioural issue.

Regulations on hours of work and rest, disciplinary actions (testing) and collective agreements have had little impact on reducing fatigue or stimulating alertness. Fatigue should therefore be addressed through shift design, workplace design, employee selection

[11] Heiler, Pickersgill and Briggs, op. cit.

[12] ibid.

and training in processes that will involve all concerned. Appropriate programmes will lead to the cultural and attitudinal changes among all the stakeholders that will improve performance, minimize errors, improve health and safety and lifestyle to the benefit of all concerned. [13]

Fatigue is widely recognized as a potential safety and health factor that needs to be managed and controlled, not least as part of the duty-of-care responsibilities that exist in some jurisdictions.

For employers, this might mean:

- ensuring employees are informed of the risks associated with fatigue and how to participate in controlling them;
- having working hours, shift rosters and shift cycles that are structured and managed to avoid or minimize fatigue;
- increasing surveillance to ensure that exposure to workplace contaminants, such as noise and hazardous substances, is controlled to within acceptable limits;
- where accommodation is on site, providing conditions that are conducive to sleep and providing employees with a balanced diet.

For employees, this might mean:

- ensuring that their activities outside working hours do not inhibit their ability to carry out their duties without risk to their own or other employees' safety and health;
- ensuring they get adequate sleep and are not in a fatigued state before commencing a shift.

One guideline on the management of fatigue in mining shows how employers may:

- conduct a risk assessment that takes into account the risk factors associated with fatigue;
- apply measures, as appropriate, adequately to control the risks;
- document details of the assessment in the mine's safety and health management plan. [14]

Fatigue and safety are discussed in the next section.

Working time and safety and health

Shift work can have consequences for the health of individuals, for family and social life and for work performance, unless adequate safeguards are put in place to counter such

[13] William Sirois: "Managing the human consequences of 24-hour mining operations", paper presented at Minesafe International 2000, Perth, Western Australia, 3-8 September 2000.

[14] Mines Occupational Safety and Health Advisory Board: *Fatigue management for the Western Australian mining industry: Guidelines* (Perth, Department of Minerals and Energy, 2000).

effects. The ILO *Encyclopaedia of Occupational Health and Safety* discusses aspects of the health effects of shift work, the social problems of shiftworkers, worker performance, and the design, duration and timing of shifts. [15]

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 less sleep, there exists a range of identifiable health problems associated with shift work, particularly but not exclusively night work. Some problems arise soon after starting shift work, others appear over the longer term. The effects are associated with both biological disruption and "lifestyle issues", such as poor eating and sleeping habits. They may combine to impair health, safety, work performance and social participation. There are four principal groups of issues:

- 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, neuro-physico and, possibly, cardiovascular functions.

- Shift work-induced lifestyle problems – manifested in various complaints and disorders such as poor quality and not enough 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.

An important issue to take into account is toxic exposure during extended working hours and the degree of toxic clearance that occurs during time off. Exposure limits that are based on an eight-hour period cannot be simply extrapolated to cover a 12-hour shift.

The days of paying extra for long hours of work, particularly in hazardous environments, are increasingly a thing of the past. The duty-of-care provisions that exist in much legislation mean that hazards associated with work systems should be eliminated or controlled as far as practicable. This duty of care is extending to cover shift work too, especially where exposure to hazards such as dust, noise and heat are concerned. But the Australian study, for example, found that there had been less focus on the organizational responsibilities of ensuring that rosters are well designed to minimize biological disruption, and are implemented so that work is scheduled in a way that is sensitive to the human need for adequate rest and recuperation. [16]

Fatigue and safety

The principal safety and health concern associated with shift work and continuous operations is that of fatigue and its effect on performance (table 2.2).

[15] ILO: *Encyclopaedia of Occupational Health and Safety*, Ch. 24 and Ch. 43 (Geneva, 1998).

[16] Heiler, Pickersgill and Briggs, op. cit.

Table 2.2. Potential effects of 24x7 mining operations

Employees	Performance	Health and well being	Family and social life
Disrupted sleep at home	Low morale	Cardiovascular disease	Irritability
Chronic sleep deprivation	Decreased motivation	Gastrointestinal disorders	Domestic violence
Lack of awareness of extent of sleep debt	Increased accidents/injuries	Circulatory disease	Lack of communication
Micro-sleep on and off job	Reduced product quality	Chronic sleep disorders	Lack of participation
Automatic behaviour syndrome	Reduced productivity	Dormant medical problems triggered	Withdrawal
Reduced alertness, vigilance, performance at work	Burn-out/employee attrition		Increased divorce rate

Source: William Sirois: op. cit.

Fatigue, or impaired alertness, is a fundamental problem for all continuous operations. The cycles of sleep deprivation that are the lot of shiftworkers often leave them in a pathologically sleepy state at all hours of the day and night. Tired people exhibit the same levels of performance impairment as those who are legally intoxicated. Tests have shown that moderate levels of fatigue produce higher levels of performance impairment than the proscribed level of alcohol intoxication. For example, after 17 hours of sustained wakefulness, cognitive psychomotor performance among a group of 40 people decreased to a level equivalent to the performance impairment observed when the group had a blood alcohol concentration of 0.05 per cent. This is the proscribed level of alcohol intoxication in many countries. [17] After 24 hours of sustained wakefulness, the group's performance decreased to a level equivalent to the performance deficit observed when they had a blood alcohol concentration of about 0.1 per cent, twice the legal limit in many countries. Thus relatively moderate levels of fatigue impair performance to an extent equivalent to or exceeding the currently acceptable level for alcohol intoxication.

Performance impairment 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;
- tendency to sacrifice accuracy for speed;
- failure to recognize the existence of a problem;

[17] Drew Dawson and Kathryn Reid: "Fatigue, alcohol and performance impairment", in *Nature* (London, Macmillan Publishers Ltd.), Vol. 388, 1997, p. 236.

- reduction in secondary task function;
- increased stress, frustration, irritability.

Equating fatigue-related impairment to "blood alcohol equivalent" provides policy-makers and the social partners with a clear index of the extent of impairment associated with fatigue.

What to do?

It can be safely said that the use of extended workdays in mining should be accompanied by special efforts to create and maintain safe and healthy working conditions. Also, since the probable consequences of extended work shifts cannot be predicted with certainty, each miner should be evaluated on a periodic basis.

Where it does not exist, there is a strong case for introducing data relating to working time into accident and incident reports, such as:

- the time into the shift of the occurrence;
- the position of the shift in the cycle (i.e. the number of consecutive shifts the employee has worked);
- the shift schedule that the employee was working on;
- the number of employees on that roster, and on the shift at the time;
- whether the person(s) concerned are permanent employees or subcontractors.

Studying health and shift work has proved difficult. Cross-sectional studies – taking a picture at a certain point in time – tend to show that shiftworkers are of above average health. But there are major exceptions and shift work can cause health problems of many kinds and of varying degrees of severity. But it does not happen everywhere and in every category with an inevitability that results in a statistically significant outcome every time. [18]

Sleep difficulties are often seen as the root cause of many of the problems associated with shift work. A person who is short of sleep can be a tired and dangerous worker, an irritable and bad-tempered member of the family and can be building up to other problems (e.g. digestive problems). However, measures to counter some sleep problems are effective for some people. Digestive problems are the most clearly established health consequences of shift work, but they are not universal and there is scope to alleviate them through educational programmes that lead to new eating habits.

It is clearly important to monitor shiftworkers' health on a regular basis; systematic monitoring will lead to better information on the health effects of shift work. The right to medical checks at the start of a new shift work programme and at regular intervals – at no cost to the worker – is included in the European Working Time Directive. If this requirement were replicated throughout the mining industry – in collective agreements for example – it would be a spur to better medical support for shiftworkers, better long-term

[18] European Foundation for the Improvement of Living and Working Conditions: *Bulletin of European Studies on Time* (Dublin), No. 1, 2000 (www.eurofound.eu.int).

follow-up and research, and a deeper understanding of the way health evolves under different shiftworking arrangements.

A happy social and domestic life is an important foundation for good mental health; shift work can put a strain on this. "Family-friendly" policies can help, particularly where they are developed through social dialogue involving all those concerned. Training in developing emotionally positive outlooks or providing an element of choice could help in this respect.

The body of literature on shift work and working time is substantial and goes back many years. The fact that the same issues – fatigue, health, safety, industrial relations, social issues, lifestyle – keep surfacing, points to the need to take individual circumstances fully into account, rather than try to find a one-size-fits-all solution. The current challenge for the mining industry is to acknowledge that these hazards exist and to develop preventive strategies that can be implemented within the diverse range of social, political and industrial environments in which mines conduct their physical operations.

Social dialogue and working time

Hours of work are a key issue in bargaining – whether it is undertaken collectively, at the workplace or individually, by unions or in their absence. In 1999, over 80 per cent of collective and individual agreements that were current in Australia contained provisions on hours of work, second only to provisions on grievance procedures. An analysis of the relationship between longer hours and the form of bargaining showed that the higher incidence of long hours at workplaces was most strongly related to workplaces where individual contracts were in place. Moreover, certain 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 are more likely to be included in non-union and individual agreements.

The emergence of new forms of bargaining has put pressure on the traditional structures for setting and managing the parameters for working-time arrangements. These pressures are strong in the Australian mining industry. The introduction of Australian workplace agreements in 1996 provided the opportunity to bypass established awards, customs, practices, trade unions and collective bargaining when establishing new working arrangements. [19]

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. A key industrial relations issue is how to translate such awareness into (non-threatening) information from which effective preventative strategies can be developed.

The workforce in mining (as in other industries) has become less secure, with widespread downsizing and restructuring. Because lifestyles have developed based on the high incomes associated with long hours and additional regular overtime, workers are naturally more likely to focus on (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.

[19] Heilier, Pickersgill and Briggs, op. cit.

At the same time, management sometimes finds itself supporting extended shifts, largely due to perceived or actual gains in labour flexibility and productivity. 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.

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 for members. They may (and do) raise hours of work, safety and fatigue concerns in educational programmes. Pragmatically, however, unions must balance such concerns against the obvious risk of alienating and possibly losing large parts of their membership which can opt for the short-term financial inducements associated with offers of individual contracts. It seems that the risks associated with extended roster working arrangements are, at present, outweighed by the industrial and financial risks of opposing them. This is true for all parties involved and provides a major challenge for regulators.

Where there is no legislation that governs working time, unions are seeking the establishment of "reasonable hours of work" that take a range of factors into account when non-standard working arrangements are being considered. These factors, which are similar to those governing good shift design, include:

- the number of hours worked without a break;
- time off between shifts;
- risk of fatigue;
- rostering arrangements;
- extent of night work;
- employee workload;
- work intensification resulting from understaffing;
- ability of workers to meet targets;
- exposure to occupational health and safety hazards;
- employees' social and community life;
- employees' family responsibilities;
- travelling time and rest breaks. [20]

Negotiations concerning the organization of work should include a variety of support programmes (such as career breaks, assistance schemes, relocation assistance, study assistance, travel arrangements), training, minimum employment levels and risk assessment, and not merely focus on remuneration. For example, when scheduling training, in addition to enabling employees to attend training and refresher training, consideration should be given to enabling them to participate in decisions that affect safety and health in

[20] Maher, op. cit.

order to permit them to gain specialized knowledge and skills, and to participate in the design and implementation of training programmes.

Employees need to know if the prospect of longer periods of time off is likely to be compromised by the need to recover from longer periods at work. Employers need to know how efficiency and productivity might be affected, including changeovers and absenteeism.

It is critical for the social partners to ensure that the advantages of new working arrangements outweigh any disadvantages, in the short and long term. The importance of careful trials and evaluations is underlined – including periodic evaluation of individual workers (before changes too).

These principles necessitate having well-established occupational safety and health management systems in place that contain the key elements of policy, organization, planning, implementation, evaluation and action. The ILO produced a set of guidelines in 2001 to assist in setting up these systems through a process of social dialogue. [21]

[21] ILO: *Guidelines on occupational safety and health management systems: ILO-OSH 2001* (Geneva, 2001).

3. Evolution of training

Younger technologies and an older workforce highlight the need for training, retraining and lifelong learning as significant components of labour market adjustment. The demand is increasingly for more advanced and different skills, together with a mix of skills, across all sectors of the economy. In the European Union by the end of 2010 over 50 per cent of the workforce will have received their final education and training a decade earlier.

Workers, especially in an increasingly capital-intensive, high-tech and competitive mining industry, need higher levels of education, as well as abilities and behavioural characteristics that help them adapt to rapidly changing work and social environments. People's ability to find and retain a job has much to do with their possession of "foundation skills" that need to be regularly updated and supported with specific skills through training and lifelong learning processes. The first issue is to identify what these skills are; the second, to see whether they are in adequate supply. Much evidence says they are not – skills shortages exist. [1]

Training and learning

Training and learning are not always closely linked. Training is a learning event that takes place in an organized context – at work or outside. Learning is ongoing and is a more knowledge-oriented individual activity that depends on how the worker absorbs and applies the training he or she receives.

Translating the theory of lifelong learning into the practice of professional development may require rethinking the traditional path from primary through secondary to tertiary education. More flexibility may be required – particularly in technical and tertiary education – if the specific needs of the mining industry are to be met quickly and when required.

Changes in work organization require all employees to acquire more skills, for example, to perform individual tasks, manage several different tasks within the job, respond to irregularities and breakdowns in routine, and deal with the responsibilities and expectations of the work environment. Managerial and, increasingly, supervisory staff need skills of written and verbal communication, teamwork, interpersonal sensitivity, leadership, management planning, analytical reasoning, problem-solving, decision-making, creativity, entrepreneurial spirit, dynamism, energy and initiative, and stress management. A tall order, but all these skills are required to a certain extent throughout the organization.

In order to meet the challenges ahead, education and training must meet the following requirements: basic education; core work skills; and lifelong learning for all. Basic education in "foundation skills" such as literacy, numeracy, citizenship, social skills, learning-to-learn skills, and the ability to solve problems together is fundamental. But in some countries such skills are inadequate or missing among those who work or wish to work in the mining industry. The industry has therefore had to provide them. [2]

[1] ILO: *World Employment Report 2001*, p. 217 (Geneva, 2001).

[2] ILO: *Learning and training for work in the knowledge society*, Report IV(1) International Labour Conference, 91st Session, Geneva, 2003, p. 12.

Core work skills are the non-technical skills necessary for satisfactory work performance, and for navigating the labour market. Lifelong learning is the new catchword for education and training policies. It ensures that the individual's competencies are maintained and improved as work, technology and skill requirements change; it ensures personal and career development; it results in increased productivity and income; and it improves social equity. [3]

Active labour market policies are an important factor in addressing unemployment arising from restructuring and market-based economic reforms, such as have affected the mining industry in countries in transition and elsewhere. If active labour market measures, such as job-search assistance and employment services, retraining of workers who are laid off, employment and wage subsidies, are part of a package of mutually supportive services, such as remedial education, they are likely to be more effective in reintegrating people into employment than if they are implemented in isolation. They also require a sound institutional framework if they are to have a sustained, positive impact.

Increasingly, many mining enterprises have an ageing workforce (the average age is over 50 in the United States mining industry and well over 40 in several other major mining countries) and face skill shortages and difficulties in recruiting younger workers. They have to recognize and depend on their older workers as a valuable resource.

Basic education: The road to employability

Basic education has a decisive bearing on a person's ability to find and retain a job. Core work skills should not be limited to literacy and numeracy but encompass social skills and work culture. Moreover, they should be obtained by everyone before leaving school. Vocational education and initial training have to build on the core skills, either inside or outside the formal training system. Work-oriented vocational training has been an important means for school-leavers and the unemployed to improve their skills.

Functional illiteracy: A widespread problem

The widespread problem of functional illiteracy in the workplace has substantial implications for most aspects of work, particularly health and safety. Workers who are unable to understand written instructions or communicate effectively with other workers are a risk to themselves and to others, even though they would have received formal training. New work methods put the spotlight on the ability to absorb and retain information, to analyse and react to stimuli in the workplace and, above all, to communicate. Hence, attention is being paid to providing basic education to the existing workforce, where it is lacking, and to insisting on higher levels of educational achievement in new workers.

Typically, a functionally illiterate worker is someone who:

- has good spoken skills in the working language, including if it his or her mother tongue;
- is able to read a newspaper;
- is able to go shopping and do simple maths; but

[3] ibid., p. 13.

- is unable fully to comprehend safety materials and training and other technical literature needed for his or her work.

Functional literacy has been defined as not only the ability to read, write and speak the working language but also to compute and solve problems encountered on the job and in society. While these types of skills may not be what is normally thought of as defining literacy, they have been used to define what is known as prose, document and quantitative literacy. Briefly, these can be defined as:

- *prose literacy:* the ability to understand and use information from various kinds of prose texts, including newspapers, magazines and brochures;

- *document literacy:* the ability to locate and use information contained in materials such as tables, schedules, charts, graphs and maps;

- *quantitative literacy:* the ability to perform arithmetic operations using numbers contained in printed texts and documents.

This broader definition of literacy can also encompass such skills as the ability to:

- work in teams;

- use various computer technologies on the job;

- multi-task;

- apply critical and creative thinking to problem solving. [4]

Imparting the basic skills

Learning does not have to be an accidental outcome at work. It can be used to meet individual development needs while harnessing it to advance the enterprise's strategic and organizational objectives. Learning-rich work environments can be promoted by capturing and exploiting the experience of co-workers, developing flatter structures and encouraging team-building.

People with little education often face barriers when entering a job for the first time, or a new job for those who have been laid off. The mining industry in South Africa has a wide-ranging programme to provide basic education to its workers (see below).

Qualifications frameworks should contain three main elements:

- appropriate, transferable, broad and industry-based competency standards, established by the social partners, that reflect the skills required;

- a credible, fair and transparent system of assessment of skills gained – no matter where and how;

[4] Chris Hanson and Dianne Gardner: "The impact of functionally illiterate native English speakers on workplace safety", in *Journal of Occupational Health and Safety, Australia and New Zealand* (North Ryde), Vol. 18, No. 1, Feb. 2002, pp. 45-54.

- a credible system of certification of skills that are portable and recognized. [5]

The mining industry, like any other, needs an institutional framework in order to develop coherent competency standards and systems of assessment, recognition and certification. How this is established and managed depends on the nature of the industry and the extent of existing national frameworks.

The introduction of new working arrangements and different models of production brings with it the need for workers to have good communication and problem-solving skills, as well as varied production skills. Mining enterprises are increasingly looking for higher levels of educational achievement and, in some cases, literacy in the new recruits that are hired, leading to a gradual improvement in the level of the workforce as a whole.

In South Africa, for example, about 40 per cent of all mineworkers have some primary education, even if they did not all finish; about 25 per cent have less than primary education; 30 per cent have some secondary education; and about 5 per cent have matriculated. The educational profile of new mineworkers is rather different, with over 40 per cent having some secondary education; 30 per cent some primary education; 10 per cent less than primary; and 20 per cent having matriculated. But the process of changing the overall skill profile has been slowed by the dramatic fall in recruitment. About 100,000 workers a year were hired by South African gold mines in the early 1990s. Ten years later this had fallen to 20,000. [6] So there is clearly a long way to go before the aim of general literacy on hiring will be reached, and even further before a majority of the entire workforce becomes functionally literate. With this in mind, large numbers of existing workers are receiving basic education and training. Moreover, as the industry, through the Mining Qualifications Authority (MQA), specifies the competencies required for each task – in terms of the South African Qualifications Authority Act, providing the training necessary to achieve the requisite competency will be important for those who have gained a sound basic education.

A question of competence

Competency standards are an essential link between marketable employment requirements and systems and programmes for learning, education and training. They can guide training and help individuals develop and maintain employability. They also provide a basis for making rational decisions regarding learning and training. Skills assessment enables people to have their skills tested and facilitates job entry and career mobility. Assessment can be used to benchmark the quality of training provided against the competency standards that are required. Assessment should therefore identify skill gaps, be transparent and provide guidance to the learner and the training provider. Assessment methodology should be fair, linked to standards and be non-discriminatory.

Australia's mining industry, for example, is the second smallest industry in the country in terms of both employment and the number of establishments, but it has a capital investment of about A$1 million for each job. Its workforce receives the highest full-time wage rates, includes the lowest level of part-time employment and has the lowest level of female employment of any industry in Australia. The competence of the workforce is

[5] ILO: *Learning and training for work …*, op. cit., p. 71.

[6] University of Cape Town Business School: *The South African mining industry in the 21st century*, study prepared for the Chamber of Mines of South Africa (2000) (Chamber of Mines website www.bullion.org.za).

critical to commercial success and there has been a strong commitment over many years to structured on-the-job training, the majority of which has been competency-based. [7]

The mining workforce in Australia differs in several respects from industry as a whole, including having a higher proportion of production and transport workers (37.4 per cent v. 9.2 per cent) and a higher proportion of tradespersons (22.5 per cent v. 13.7 per cent). The mining industry has for some time been at the leading edge in the development and implementation of multi-skilled jobs, career paths, formalized skill development programmes and skill utilization payment systems.

Skills training is largely an outcome of work organization, which in the Australian mining industry had been determined by the industrial relations legislation in force. The significant changes in this legislation that were introduced in the mid-1980s and 1990s led to a framework to encourage the industrial parties to improve efficiency and productivity by linking the capacity for improvements in wages and working conditions to the modernization of industrial agreements and workplace reform. The recognition that increased remuneration was linked to improvements in productivity and efficiency led to the introduction of "broad-banding" and "multi-skilling".

The need to train and maintain a properly skilled workforce has led the mining industry to place strong emphasis on on-the-job training (85 per cent of all training) and to develop multi-skilled jobs, formal skill development programmes and payment systems based on skill use. About three-quarters of work organization systems in the Australian mining industry reflect these developments (box 3.1).

[7] National Mining Industry Training Advisory Body Ltd., personal communication.

Box. 3.1. Towards industry-wide competence: An Australian approach

The fact that the Australian mining industry spends more than any other per employee on training – in terms of money, time and proportion of the payroll (over three times the average time and over four times the average expenditure per employee) is evidence of a well-established training culture. The decision in 1992 to develop a National Vocational Education and Training (VET) system that provided nationally recognized and portable job skill qualifications for all who wanted or needed them, was a significant initiative for the mining industry. At that time, the only workers who had a nationally acceptable qualification were tradespersons – about 30 per cent of the workforce.

The national training framework came into operation in 1998. The core of the programme is competency-based training, which means:

- being clear about what people should do after training;
- basing training on that predetermined outcome, including what people know and giving them the opportunity to practise applying the knowledge to develop the required skills;
- seeing that people can do what they are required to do.

Instead of focusing on a structured sequence of VET that generally results in an assessment against a range of learning outcomes specified in an accredited curriculum, and usually associated with institutional delay, the new system focuses on what is expected of an employee at the workplace. Outcomes, in terms of qualifications, are driven by the competencies attained as assessed by experienced people.

Endorsed industry competence standards and a credential under the Australian Qualifications Framework are the "bookends" of the training system. The endorsed standards establish the competencies required for effective performance in employment. They are developed and defined through extensive social dialogue at the industry and enterprise levels. They are endorsed nationally under a consultation regime administered by the National Training Authority.

Industry input into the VET system is coordinated by the National Industry Training Advisory Body (ITAB) network. The state and territory networks form a critical link between enterprises and the national body. The mining industry, with its long history of effective skills training, was sceptical of the idea of national coordination of training and wary of possible coercion and interference in something it was very good at. But recognition of the benefits of having national and transferable industry qualifications for Australia's mining workforce led to the establishment of the national mining ITAB in 1995. It covers all mining and provides a strong industry voice on VET issues in the publicly funded training system. It is also the coordinating body for the industry to define its skills' competency standards and translate them into the training packages that are the core of the VET system.

National training packages provide skills qualifications in a variety of areas in different mining operations. Each company will still conduct its own skills training to suit specific needs, but there is now the option to enhance the value of the training through the national VET network. Importantly, the national training packages do not set out the "how", "what", "when" and "where" of training. Rather they define groups of skill competencies that are aligned at various levels and provide the mechanism for assessing them.

Mining enterprises are increasingly using training packages to provide their workers with the opportunity to obtain national recognition of their skills – something previously denied to them.

Source: National Mining Industry Training Advisory Body Ltd., personal communication.

As with most illustrations, what will work well in one situation might not be appropriate elsewhere. But there are key elements in any approach that should, like good training, be recognized and transferable, particularly in view of the extent to which major multinational mining companies are involved in many countries. Regional approaches to getting the training and other messages across differ. In South Africa, for example, industrial theatre has proved to be a powerful and effective tool, particularly for improving internal communication – a sort of choreographed social dialogue (box 3.2).

Box 3.2. Curtain up for training

Industrial theatre offers skills borrowed from the performing arts to train, to tease out problems, to communicate, to build teams and to ease in changes. It gives workers and management an opportunity to examine the past, present and possible futures, and to rehearse how they might be different. Where conventional methods might be found wanting, live performances can be a dynamic communications tool. But performance is only part of the process.

Industrial theatre companies begin by researching the problem at the site (e.g. safety, HIV/AIDS-awareness, teamwork, motivation), a script is created, a performance rehearsed and presented. At strategic points the action is stopped and the audience asked to comment and make suggestions for the protagonists to behave better. The actors adapt and replay the scene the new way. Members of the audience are encouraged to step in and take over the roles, thereby learning and rehearsing new behaviour.

At one mine, the process uncovered deeper issues than safety awareness. The workers felt undervalued and not respected by the company and so saw no reason to respect safety rules. In response, the company committed itself to improving working conditions and living standards in the miners' hostels. After winning the workers' trust and cooperation, serious injuries fell by 17 per cent and minor injuries by 43 per cent. (It is not reported to what extent these improvements were sustained over time.)

Source: Jon Trevor: "Setting the scene for a happier workplace", in *Financial Times*, 9-10 Mar. 2002, p. II.

The success of industrial theatre in South Africa is partly attributed to a strong tradition of teaching through storytelling, song and dance. But it is also due to the widespread illiteracy among the mining workforce, which led to the need to develop ways of communicating that circumvented the written word.

Transferable qualifications are being considered in South Africa in the context of the development of the National Qualifications Framework (NQF) that unites one level of learning with another without restrictions and links the domains of education and training. The mining industry, through the tripartite Mining Qualifications Authority (MQA) – which was established to set education and training standards in the mining industry and to maintain and monitor their quality – is implementing a policy to upgrade the skills of its workforce. The following goals are being pursued:

- the generation of unit standards and the design of qualifications to improve health and safety standards in the mining industry;
- the registration of mining industry standards and qualifications in the NQF;
- the establishment of a quality assurance system that includes accreditation, assessment and moderation;
- the design and delivery of learning that meets the overall policy goals of having a sufficiently and appropriately skilled workforce;
- to increase the skill base in mines to a level where functional illiteracy and innumeracy are eradicated and where an acceptable proportion of the workforce has access to further career advancement and learning. [8]

ICT opens new doors: Real and virtual

Information and communication technology (ICT) has expanded opportunities for learning in the workplace, and online learning in the workplace is the fastest expanding

[8] Chamber of Mines of South Africa: *Annual Report 2001*, p. 57-63 (Johannesburg).

area of learning, education and training today. The increasing sophistication of computers and software means that realistic "hands-on" training can be provided that explores a variety of situations that would be impossible in real life, and provides immediate feedback. Clearly there needs to be a combination of training in real and virtual situations, alone and with co-workers, each method reinforcing the other.

There is also a strong programme throughout the industry to combat adult illiteracy and improve basic education. Adult Basic Education and Training (ABET) is an ambitious programme that involves many South African mining companies and the National Union of Mineworkers (NUM). At one company it was not until modern technology replaced traditional classroom methods that encouraging results began to be achieved (box 3.3).

Box 3.3. Using computers to overcome adult illiteracy

The learning process begins with basic training on how to use a computer mouse, something that is not a barrier to an illiterate person, so that the interactive training programme can be used. People work at their own pace through programmes in literacy and numeracy, assisted by trained facilitators who also mark their work. The task-driven process requires higher concentration than in a class and achieves better retention rates. Also, trainees are more receptive to undertaking the training than if it were provided in a traditional classroom manner. As the students learn, they also become familiar with new technology. ABET is either provided on a full-time basis at a training centre over three months or so, or after hours on a continuous basis. In the former case, students complete the course before resuming full-time work. The main problem that affects how the training is delivered is that of knowledge retention. Full-time attendance instead of working ensures attendance, but long-term retention is not as good since training is normally carried out once a year at most. Thus by the time students return to undertake the next level, much of what has been learned has been forgotten. Continual after hours training can promote an attitude of lifelong learning and knowledge retention is generally better, but it is hard to motivate people to give up their own time to undertake training notwithstanding the carrot of opportunities for advancement and higher pay. One solution being tried is to bring full-time trainees back one day a month to revise and review their training. One group of coalmines has used this technique since early 2000. Forty students have been studying English and mathematics, 15 of these have completed their Elementary Technical Certificate which is the bridging course for engineering science vocational qualifications.

Source: "Mining group combats adult illiteracy", in *African Mining* (Johannesburg, Brooke Pattrick Publications), Sep./Oct. 2001, pp. 68-69.

Distance-learning programmes that exploit IT can be an effective means of providing learning and training to workers at remote sites, including interactive dynamic and action-oriented content that can be watched live on TV or recorded on video. The challenge of harnessing ICT in education and training should not be underestimated. Ingrained professional and cultural habits and attributes will have to be overcome. But the greatest challenge will be to ensure that all concerned have the requisite basic education for access to ICT.

Virtual reality [9]

Repetitive classroom training, plus instruction in a physical mock-up of a workplace, followed by on-the-job training, have hitherto been the principal training methods available. Their limitations are clear, especially in countries with continually high accident rates. New technology opens the door to interactive and realistic training methods for all mining training. Virtual reality (VR) training has a number of applications in the mining

[9] Robin Hollands et al.: "Equipment operation/safety training using virtual reality and SAFE-VR", paper presented at Minesafe International 2000, Perth, 3-8 September 2000; A.P. Squelch: "Virtual reality for mine safety training in South Africa", in *The Journal of the South African Institute of Mining and Metallurgy* (Johannesburg), July 2001, pp. 209-216; Research Triangle Institute International: *Virtual reality multimedia training* (www.rti.org/vr/w/vrtrain.cfm).

industry: new recruits can familiarize themselves with the mine's layout before going on site (above or below ground); control-room operators can rehearse occasional or emergency situations within a virtual mine that is identical to the actual operation; and equipment operators can learn new control and operational procedures on a virtual vehicle, including on prototypes.

VR can be defined as the three-dimensional computer-generated representation of real or imaginary worlds within which a user can interact in real time and experience the feeling of being present in those worlds. Faster and cheaper computers and sophisticated video games have provided the way forward for VR technology as a training tool.

Clearly, safety training will continue to be a cornerstone of all mine training, regardless of how differently work might be undertaken. As the industry changes, fewer but more highly skilled workers are required. They are a valuable resource that must be protected. Health training will also have to be more widespread in the light of the increasing need to address it to the same extent that safety has long been addressed. Moreover, providing all mineworkers with effective training and skills so that they can work safely is a legal requirement in most countries.

VR has also proved to be useful when working conditions are hazardous, when interaction with equipment is required but it is expensive or unavailable, when down-time is costly, or when changes need to be incorporated quickly. Moreover, by using VR, operators can "control" valuable equipment in hazardous circumstances. In addition to being able to simulate dangerous occurrences in the workplace, VR can reduce learning time and investment in training. It is also claimed to provide a range of advantages over conventional training, including:

- being a low-cost alternative to creating full-scale physical training scenarios;
- being flexible and easily modified;
- providing an opportunity for a range of scenarios that can be run repeatedly and to order;
- having built-in monitoring of progress during training;
- providing for appropriate levels of trainee interaction.

Since much classroom training and even "mock-up" training is perceived as boring, the potential for the message to fail to be received and retained is high. Simulation techniques – especially for new workers – can provide an exciting, serious and verifiable form of training. Trainees cannot successfully complete a session unless they correctly interpret and react to the scenario and images being presented.

As with all innovations, care needs to be taken with the introduction and use of VR training. It will not replace all other forms, rather it will reinforce them, bridging the gap between the classroom and the workplace – between knowledge and skills. Neither will VR be suitable for all workers. Some form of assessment for suitability will ensure that VR is used appropriately. Target groups have both accepted and understood VR as a realistic training medium that can raise the level of hazard-awareness training, both generally and in specific circumstances.

Beyond VR

Even as VR is being considered and many potential applications exist for the mining industry, technology marches on towards the development of augmented reality (AR). AR

combines computer-generated imagery with views of the real world to provide enhanced understanding to the user. However, rather than wait for the "latest model", serious consideration should be given now to see how existing VR training could be used in both broad and site- and process-specific training programmes.

Retraining: The key to new decent work

Restructuring and collective bargaining have led mining companies to assist retrenched workers in preparing for a life after mining employment. Many retrenchment contracts are now linked to retraining schemes. In some cases workers are given vouchers that can be exchanged for training at a range of institutions for an agreed period after retrenchment (e.g. up to two years). The mixed results with severance packages have prompted different agencies in several countries to pay more attention to the provision of financial services and advice.

Older workers often face serious obstacles in gaining access to training programmes that would assist them in maintaining their jobs or – as is often the case in the mining industry – finding new employment. Reduced access by older workers to job-related training undermines their ability to remain employable while work requirements change. For unemployed older workers with marketable skills, job-search assistance and counselling have proved to be invaluable in helping them find a new job. Few countries have public training and/or job-search assistance schemes for older workers. Those that do have achieved excellent placement rates. [10]

The United Mine Workers of America (UMWA) runs three centres (in West Virginia, Pennsylvania and Ohio) to prepare and place unemployed coalminers in new jobs. There were almost 83,000 fewer miners at work in 1990 in these states than in 1984. The career centres, which work with federal, state and local programmes, have proved to be an important means for laid-off miners to develop new job skills and find new jobs (box 3.4).

Box 3.4. Providing opportunities for unemployed coalminers in the United States

In 1988, the United Mine Workers of America (UMWA) established the UMWA/BCOA Training and Education Fund. It provided benefits to over 1,500 unemployed miners and over 5,000 of their dependants, paying out in excess of $41.5 million for tuition. Many miners felt they could best help their families by continuing to work while their dependants took advantage of the training and education fund. For many, the only option was to work in "dead-end" jobs for low wages. They had few transferable skills.

In the mid-1990s UMWA turned to the federal and state governments for assistance in providing skills training that would equip its members for more productive, better-paid jobs. Between 1996 and the end of 2001 the career centres had recruited over 3,300 former miners, trained over 1,800 and placed almost 2,500 in new jobs in five Appalachian states, with an average wage of $13.50 an hour. In each location the programme has exceeded its goals in terms of numbers trained and placed and the average wages achieved. The UMWA is currently seeking additional funds to keep the centres open in the face of reduced government funding for long-term dislocated workers, of which over 32,000 are former coalminers in "low-paid dead-end jobs".

Source: UMWA, personal communication; "Funds sought to retrain coalminers", in Coal Age, Dec. 2001, p. 20 (www.coalage.com).

In the South African context, the retraining of retrenched mineworkers takes on an added dimension in the light of the fact that many are migrants who have returned home. They must therefore be located before being provided with training that will assist them where they live. A programme being undertaken by Placer Dome is one example of a

[10] ILO: *Learning and training for work …,* op. cit., pp. 65-66.

comprehensive approach to providing assistance to retrenched mineworkers and their families (box 3.5).

Box 3.5. The South Deep Care Project

In October 1999 Placer Dome retrenched 2,560 workers from its South Deep Mine, including 230 skilled and clerical workers. These mineworkers came from communities in South Africa and from Botswana, Lesotho and Mozambique. The retrenchments caused considerable bitterness in the community and in the trade union movement, spurring mass demonstrations. The company decided to provide support for the retrenched employees and their families and, following consultations with the workers themselves, the Care Project was launched in late 1999. Its focus is on identifying local opportunities for small business development, providing skills training and facilitating start-up capital for viable ventures. The project will also benefit miners who are unable to work because of the HIV/AIDS pandemic and provides counselling to the victims of the disease and to their families. Several problems had to be overcome: finding the workers who had returned to their countries; overcoming widespread scepticism; and dealing with illiteracy before starting a training programme. In some locations, language was also a problem.

Development workers hired from the local community are trained and employed to work directly with the retrenched mineworkers and their extended families. More than 40 development workers have been trained, and 20 of them are full-time employees of the Care Project. These field workers provide counselling on skills training options and local economic opportunities, such as home appliance repair and solar panel installation. Skills and vocational training is then organized, including the provision of travel and accommodation at the training centre during courses that last up to four months. The abovementioned problems meant that the training took far longer to organize and complete than was first envisaged. At the end of 2001, three training courses in TV and home appliance repair and the installation of solar panels had been conducted, each with 20 participants. The question of providing micro-finance to enable trained people to set up in business and eventually employ others is also one that is proving difficult to address.

A unique feature of the Care Project is that the retrenched mineworker can nominate a proxy from his/her immediate or extended family. In this way the benefits of the project are extended beyond the original retrenched worker, who for various reasons might be unable to benefit from the programme. In the courses mentioned above, about 40 per cent of the trainees were women, nominated by their husbands.

Source: Placer Dome, personal communication.

The National Union of Mineworkers in South Africa is also heavily involved in job creation and training for former mineworkers through its Mineworkers' Development Agency (MDA). The Agency focuses on creating jobs in rural areas – the main suppliers of mineworkers – through self-employment and small business support. After five years devoted to the development of cooperatives as a mechanism for creating jobs, the MDA turned to a more inclusive approach to reach more people. A number of development centres were established. They provide economic services, training and counselling and assistance in accessing external markets. Economic services operate on the basis of full cost recovery, while the other two entail a mix of user charges and subsidies from donors.

The MDA soon realized that training alone did not take new entrepreneurs far; a range of business support services was also necessary. There are a number of constraints that have to be overcome if enterprises are to flourish in a rural market. If they are not, despite training, they will only survive until the initial grant or loan runs out (box 3.6).

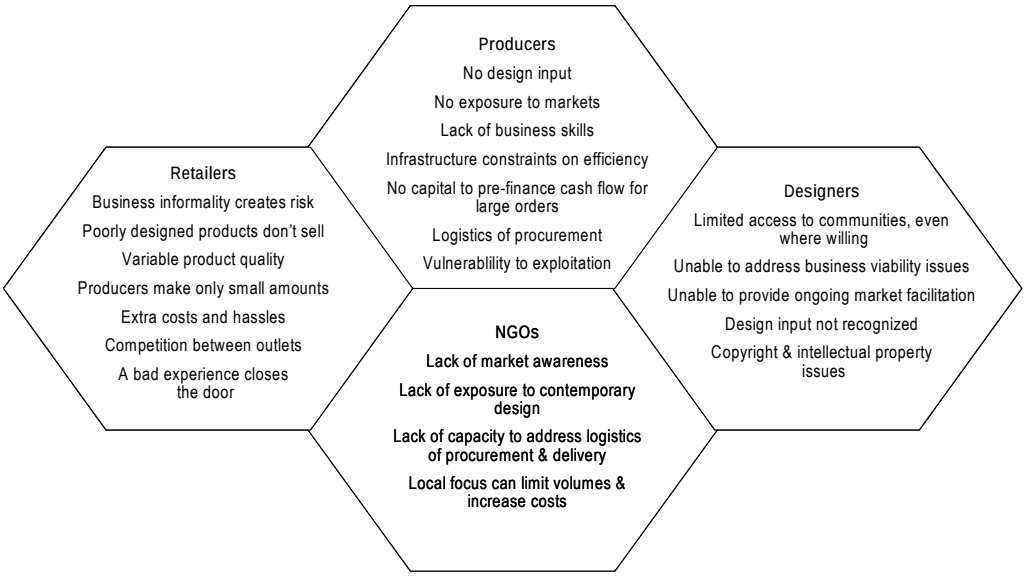
Box 3.6. Beyond training for success beyond mining

Constraints that affect rural businesses include a lack of diversity and a lack of culture of production arising from a dependence on remittances from migrant mineworkers. It is important to demonstrate that an option is technically feasible in the local context, including the sale or hire of equipment (such as baking ovens or welding equipment). Limited diversity is compounded by a lack of access to raw material inputs for new production activities. The logistical problems that local entrepreneurs have in sourcing key inputs are a major constraint on enterprise development and on diversification. Ensuring access to inputs means that business supply stores fed by a central buying agency are an integral part of the MDA centres.

In a three-year period the MDA trained 6,200 people, 72 per cent were either former mineworkers or their In order to build on the high levels of sustained participation and deepen the social and economic impact of the activities, it is important to expand and improve mentoring and counselling and to facilitate access to higher value markets. This entails considerably enhancing the capacities of the project's staff to understand the economies where they operate, identify new business opportunities and provide more effective support. In other words, comprehensive training.

A key constraint on the level of return achieved by rural enterprises is that they generally produce for local markets that are poor as well as being well supplied with mass produced similar products. But local enterprises generally know and understand local needs and opportunities. It is when they try to expand to higher value added markets that quality, packaging and delivery problems arise (see figure below).

Barriers limiting the access of rural producers to high value markets



Facilitating access to new markets is creating challenges for the MDA too, regarding its role, how to maximize impact, and whether its approach can lead to increased returns to the producers who receive the training and assistance.

Source: Kate Philip: *The quest for rural enterprise support strategies that work: A case study of the Mineworkers' Development Agency* (Johannesburg), mimeograph, 2001.

Social dialogue and training

Social dialogue is essential for formulating sound employment policies and for mobilizing the support necessary for their implementation. Workers' and employers' representatives can offer valuable support in areas such as training and skills development. Dialogue creates incentives for all concerned to use their influence in joint regulatory bodies to expand training beyond that provided by individual employers. It also increases

the level of commitment, particularly of employers, to training goals which might otherwise be evaded if a purely administrative approach is taken.

The *Conclusions concerning human resources training and development* that were adopted by the International Labour Conference at its 88th Session in 2000 provide the ILO's constituents with an ambitious agenda for social dialogue on education and training. The social partners should strengthen social dialogue on training, share responsibility in formulating education and training policies, and engage in partnerships with each other or with governments for investing in, planning and implementing training. In training, networks of cooperation also include regional and local government (…), non-governmental organizations (NGOs), etc. Government should establish a framework for effective social dialogue and partnerships in training and employment. This should result in a coordinated education and training policy at national level, and long-term strategies, which are formulated in consultation with the social partners and are integrated with economic and employment policies. It should also include tripartite, national and sector training arrangements, and provide for a transparent and comprehensive training and labour market information system. Enterprises are primarily responsible for training their employees and apprentices, but also share responsibility in initial vocational training of young people to meet their future needs. [11]

The organization of lifelong learning and training is often a subject of social dialogue. Negotiations generally focus on financing, the management of resources, establishing qualifications frameworks, skills recognition and certification, managing programme quality and effectiveness, and meeting equity objectives. Bipartite and tripartite agreements on lifelong learning and training have multiplied recently as governments and employers' and workers' organizations have engaged in collective bargaining. Training clauses in collective agreements can provide a good basis for establishing and sharing responsibilities for building different types of partnerships and for promoting equity in training.

[11] ILO: *Resolutions adopted by the International Labour Conference at its 88th Session,* Geneva, 2000, resolution No. 111, para. 19.

4. HIV/AIDS: A cross-cutting issue

HIV/AIDS has a profound impact on workers and their families, communities, enterprises and national economies. It has become a workplace issue and a development challenge. HIV/AIDS affects the most productive sector of the labour force, those aged 20-49. The consequences for the world of work are interlinked: the epidemic cuts the supply of labour and threatens the livelihood of many workers. Increased absenteeism raises labour costs. As illness forces workers to leave their jobs, valuable skills and experience are lost. Matching labour requirements with human resource needs, especially for skilled workers, can be increasingly difficult, and costly. AIDS and TB – which is exacerbated in the presence of HIV/AIDS – are the major health challenges facing the mining industry in southern Africa. But the impact will be far wider in this fully global industry.

Scale of the problem

In sub-Saharan Africa in 2001 there were 28.1 million adults and children living with HIV/AIDS. During 2001 there were 2.3 million AIDS-related deaths and 3.4 million new infections in the region. The adult prevalence was 8.4 per cent. In southern African Development Community (SADC) countries, it ranged from 0.1 per cent to 36 per cent.

Mineworkers, their families, their communities and their mining companies, notably in sub-Saharan Africa, are particularly affected by the HIV/AIDS pandemic. In view of the prevalence of HIV/AIDS in southern Africa – the source of a significant proportion of the world's mineral production, itself a major contributor to many national economies – it is appropriate to examine it in the context of the three issues in this report: employment, working time and training. HIV/AIDS affects each of these, directly and indirectly, in the region and beyond.

In some countries, the proportion of the mining workforce that is HIV-positive is considerably above that of the population as a whole (e.g. 20 -30 per cent of the mining workforce v. 12 per cent of the general population in South Africa). When looking at men of working age (20-55) however, the proportions are very similar – about 26-27 per cent in one company's gold mines. [1] Other figures put the level of infection at 20 per cent and 30 per cent in the South African coal and gold mining industries respectively. Some companies, however, show rates of infection that are well below the average for both the industry and the surrounding community.

The mining industry (companies and trade unions) in southern Africa has been at the forefront in recognizing and tackling HIV/AIDS. In South Africa the threat was recognized in the mid-1980s and an agreement between the industry and trade unions that included preventive, employment, ethical and human rights aspects, was signed in 1991. The need to focus both on prevention and on care of HIV/AIDS sufferers was quickly recognized.

The development and implementation of any sustainable strategy requires good data on which to base analysis and projections. For HIV/AIDS this inevitably involves testing and monitoring so that predictive models for prevention, treatment and retirement can be developed. Discrimination is the core issue as far as testing is concerned. Since current legislation in South Africa precludes comprehensive testing, estimates of infection rates

[1] Interview with Dr André Bester, HIV Programme Manager, Gold Fields Ltd., Nov. 2001.

have to be obtained from proxies, such as antenatal clinics, and through voluntary testing programmes.

The relative emphasis on trying to prevent infection or dealing with its consequences depends on whether HIV infection is judged to be still rising or has peaked. In the latter case, the problem is one of dealing with the conversion of the virus to AIDS.

Economic impact

The macroeconomic impact of HIV/AIDS in southern Africa is already being felt and could be considerable, with lower GDP growth and a decline in foreign investment. A survey in February 2002 found that the spread of HIV/AIDS has contributed significantly to a decline in foreign direct investment in southern Africa, since investors now seek a rate of return of 15-20 per cent in South Africa and over 25 per cent elsewhere in the region. [2] There is a reduction in human capital and a negative impact on spending, which will shift to health care and funeral expenses.

The full economic impact of HIV/AIDS is experienced by an enterprise when an infected worker becomes too ill to continue working or dies, resulting in the loss of skills and experience, and increased costs for recruitment and training. But the effects are felt well beforehand as sickness affects both presence at work and performance when present. Productivity and profitability are increasingly compromised just as health and other costs are rising. There is a knock-on effect for the national economy as the tax base starts to contract. Means to counter increased labour turnover and absence due to illness as the disease progresses include moving to a team approach with sufficient members having a range of skills to cope if one or more team members is absent or leaves. Other measures include reasonable accommodation to adapt jobs and workplaces to the capacity of a sick worker, and the provision of treatment (see below). The additional costs can be substantial, but doing nothing will almost certainly cost more (table 4.1).

Table 4.1. Economic impact of the progression from HIV to AIDS

Progression of HIV/AIDS in the workforce	Economic impact of individual cases	Economic impact of all cases
Employee becomes HIV+	No cost to company	No cost to company
AIDS-related symptoms/sickness appear	Increased sick and other leave Work performance declines due to illness Overtime and contract labour costs to compensate for absenteeism Increased use of company health clinics Increased payouts from company health schemes Increased involvement of HR and social personnel	Labour productivity falls Labour costs increase Medical aid premiums increase Additional medical staff required Management time and resources spent on HIV/AIDS issues HIV/AIDS interventions must be designed
Employee leaves workforce due to death, sickness, resignation	Death benefit; life insurance Sickness benefit payout Funeral expenses Absences for funeral Company loans not repaid Co-workers demoralized	Increased pension fund contributions Reduced returns on training investment Effects on morale, discipline, concentration due to deaths

[2] Africa News Service, Inc.: *Africa News*, 1 Feb. 2002.

Progression of HIV/AIDS in the workforce	Economic impact of individual cases	Economic impact of all cases
Replacement worker recruited	Cost of recruitment Position vacant until replacement hired Increased overtime to cover for vacancy	Additional recruiting staff and resources Wages increase as labour markets tighten due to loss of workers
New worker trained	Cost of pre-employment training Cost of in-service training Salary paid during training	Additional training staff and resources
New worker starts work	Performance low in initial period Co-workers spend time in on-the-job training	Overall reduction in experience, skill base, institutional memory and performance Productivity affected by increased labour turnover

Source: Ralph Elias et al.: *HIV/AIDS, the mining and minerals sector and sustainable development in southern Africa* (MMSD Southern Africa); research topic 2, 2001, pp. 56-57.

Depending on the degree of labour intensity, HIV/AIDS has been estimated to add 4-5 per cent to a mining company's labour costs. [3] BHP Billiton reports an increase of 3.5 per cent at its South African coalmines; Gold Fields has estimated that the cost of doing nothing about HIV/AIDS at its gold mines would add $10-12 per ounce to the cost of production. A workplace programme for prevention and care, however, would add $2 per ounce to production costs and the currently estimated "most likely outcome" is $2.50-$3.50 per ounce of gold produced. [4] AngloGold, which has an HIV prevalence of 25-30 per cent among its 44,000 employees in South Africa, estimates that HIV/AIDS is currently adding $4-$6 per ounce to the cost of gold production. The company believes there are prospects for reducing this amount with the range of activities it has in place to address the virus. [5]

The cost naturally depends on the circumstances, especially when and at what level the incidence of HIV infection peaks, and the type of programme undertaken. One model estimates that the overall impact of HIV infection is 1.9-6.3 per cent of total salary costs. But the greatest impact is among unskilled and semi-skilled workers, where costs can reach 12 per cent of the salary bill. [6]

At Debswana in November 2000, the cost of caring for infected employees and their spouses was estimated at 10.7 per cent of the company's payroll. When the decision to provide antiretroviral therapy (ART) was made, a cost-benefit analysis showed that providing ART was more expensive than doing nothing. If the price of the drugs were to fall by 40 per cent the cost of the programme would be neutral. If the cost of ART fell further, providing it would be cheaper than doing nothing. The company's decision to provide ART was not merely based on cost. It also took into account the need to have an overall strategy to care for and support those infected and to mitigate the hard-to-quantify

[3] "Living with AIDS", in *Mining Journal*, Focus (London), 1 Sep. 2000.

[4] Dr. André Bester, see footnote 1.

[5] *AngloGold's response to HIV/AIDS*, Report released for 2001-02, 24 Apr. 2002 (www.anglogold.com).

[6] Ralph Elias et. al.: *HIV/AIDS, the mining and minerals sector and sustainable development in southern Africa* (MMSD Southern Africa); research topic 2, 2001, p. 60.

human and systemic costs such as motivation, morale and the safeguarding of the "institutional memory". [7]

Important determinants of cost are the type and structure of benefits. Pension funds, for example, cost more than provident funds. Other factors include: whether companies use medical-aid schemes or company clinics; the level of recruitment and training; the extent of capital intensity; and the use of permanent employees as opposed to subcontracting. But there is more to addressing the pandemic than mitigating the costs of treatment by reducing benefits, outsourcing tasks and substituting capital for labour in order to ensure a positive net present value. The stand taken by Debswana for example, when it decided to provide ART for infected workers and some dependants, demonstrates an approach that goes beyond the bottom line.

The more workers who require medical care and hospitalization, the greater the drain on company and national health-care resources. The diversion of money from OSH to HIV/AIDS programmes, be it prevention, medication or socio-economic support presents mining companies and health insurers with both ethical and economic problems. For example, silico-tuberculosis is considered eligible for compensation under the terms of the Employment Injury Benefits Convention, 1964 (No. 121), provided that silicosis is an essential factor in causing incapacity or death. HIV/AIDS is now the major cause of TB in South Africa, with significant cost implications for the mining industry due to the fact that TB can be compensated, even in the absence of silicosis, after 200 shifts have been worked in an environment containing silica. Moreover, even minor injuries to workers with HIV can result in significant impairment, disability and even death, with a concomitant impact on employment and training. Workers with HIV are also more susceptible to infections resulting in diarrhoea, pneumonia and skin infections. Such individuals also appear to be more sensitive to heat stress, with an impact on health and productivity. [8]

It is important to strike the right balance between the cost of prevention and care of productive workers and the cost of providing benefits to those who have had to retire, taking into account that about 80 per cent of medical treatments occur in the final two weeks of life.

Migrant labour

A key factor in the incidence of HIV infection is the practice of accommodating migrant workers in single-sex hostels, with long periods of separation from families. The precise weight of migrant labour in the HIV/AIDS equation depends on a number of factors, such as: length of stay; proximity to urban centres; and the labour intensity of the operation. Where prostitution is widespread, the incidence of STDs is another factor that accelerates transmission. But single-sex hostels are not the sole reason for the spread of HIV/AIDS in the mining sector. Poverty, gender, inequity, culture and sexuality all play a role. At Debswana's mines, for example, family accommodation is available to all workers at all grades.

[7] Interview with Mrs. Tsetsele Fantan, Director, HIV/AIDS Impact Management, Debswana, Nov. 2001.

[8] Dr. M.A.C. La Grange: *HIV/AIDS in the South African mining industry: Health and safety implications*, paper presented at Minesafe International 2000, Perth, Western Australia, 3-8 September 2000, p. 278.

Prevalence

It is still too early to establish when and at what level the prevalence of HIV infections will peak. Based on the most highly affected countries (table 4.2) it is likely that 25-35 per cent of the adult population of the SADC will become infected. In some places the prevalence might reach 50 per cent.

Table 4.2. HIV/AIDS prevalence in SADC countries, 2000

	Adult prevalence (%)	Infected people ('000 est.)	Males 15-49 ('000 est.)
Angola	2.78	160.0	60.1
Botswana	35.80	290.0	120.0
Democratic Republic of the Congo	5.07	1 100.0	447.0
Lesotho	23.57	240.0	101.8
Malawi	15.96	800.0	300.0
Mauritius	0.08	0.5	0.3
Mozambique	13.22	1 200.0	418.0
Namibia	19.54	160.0	58.4
South Africa	19.94	4 200.0	1 705.0
Swaziland	25.25	130.0	49.2
United Republic of Tanzania	8.09	1 300.0	471.0
Zambia	19.95	870.0	340.0
Zimbabwe	25.06	1 500.0	544.0

Source: UNAIDS/WHO: *Epidemiological Fact Sheets* (http://www.unaids.org/hivaidsinfo/statistics/fact_sheets/index_en.htm).

The evolution of action

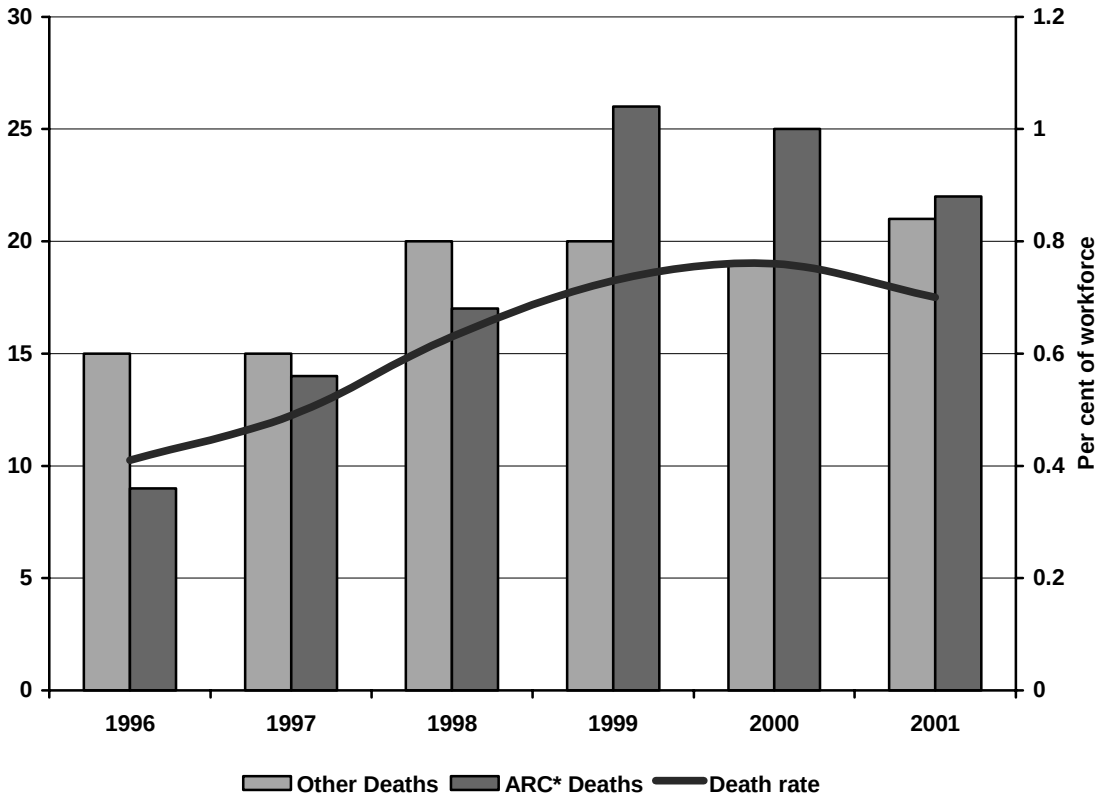
Action programmes

Mining companies, in conjunction with trade unions, governments, NGOs, community groups, donors, drug companies and research institutions, have been taking a variety of measures to prevent and combat the disease. Whether or not their success can be measured in HIV incidence rates on a site-by-site basis is debatable. Suffice it to say that, without a wholesale change in awareness, attitude and behaviour, the impact of company, community, union and government efforts will be undermined.

Debswana's response to HIV/AIDS started in 1988-89 with an education programme directed at health-care workers following the first AIDS cases seen in mine hospitals in 1987 and 1989. In 1991-92, full-time AIDS coordinators were appointed at the two principal mines. An HIV/AIDS management policy was developed in 1995. The policy was designed to serve as the basis of the education programme and to set out the company's position and practices concerning employees who were HIV-positive. The policy includes non-discrimination, no pre-employment testing and emphasizes education and information dissemination. It stipulates managerial responsibilities and sets out the roles of the various support structures – including home-based care-givers, counsellors, peer educators and a practitioners' forum.

The extent of the effect of AIDS began to be felt in Debswana in 1996 when 40 per cent of ill-health retirements were due to AIDS-related conditions. This had risen to 75 per cent in 1999. In 2001, however, it had fallen to 28.6 per cent, largely due to the decision to provide ART and the resulting strengthening of the immune systems of those being treated. In 1996 AIDS-related deaths accounted for 35 per cent of deaths in service. The figure peaked at 57 per cent in 1999; in 2001 it was 43 per cent (figure 4.1).

Figure 4.1. Deaths in service: Debswana, 1996-2001



* AIDS-related cases.
Source: Interview with Mrs. Tsetsele Fantan, Debswana.

Planning for future risk-reduction strategies requires knowledge of the level of HIV prevalence among the workforce rather than making assumptions based on absences due to illness. At Debswana, this was the reason for the voluntary anonymous survey.

As HIV/AIDS moved from being a health and safety issue to one that needed special attention, a multi-pronged policy has been developed to cover infection reduction, wellness programmes, cost containment, stakeholder engagement, evaluation and monitoring, and communication. All companies that provide goods and services to Debswana are required to support its initiatives and have in place their own workplace policy and programme that will be regularly audited by Debswana. This is also an important means for the company to use its considerable influence beyond the perimeter fence.

In March 2001 Debswana decided to provide ART for employees living with AIDS. The company meets 90 per cent of the costs incurred by the employee and one legally married spouse who is HIV-positive, as long as the employee remains in service.

Other mining companies are addressing HIV/AIDS in broadly similar ways. A major difference between them is the extent to which ART drugs are provided.

Box 4.1. Mission statements on HIV/AIDS

As major mining companies operating in southern Africa and the trade union movement have sharpened their focus on HIV/AIDS, they have developed, publicized and implemented policies and programmes to address the pandemic. The following examples of "mission statements" are drawn from annual reports and other documents in the public domain.

Anglo American. To put more emphasis in each company on controlling and minimizing the impact of HIV/AIDS building on the initial focus on awareness, education and the prevention of infection.

AngloGold. To implement a comprehensive response focusing on prevention management, caring for those infected, and conducting health research while at the same time continuing to function as a profitable entity.

BHP Billiton. To try to prevent infection and deal with its consequences through programmes for preventing TB, enabling post-retirement medical cover, home-based care, community education.

Debswana. To reduce the impact of HIV/AIDS on employees, their families and the company through the prevention of new infections, the care and support of those infected and the containment of costs.

Gold Fields. To manage the impact of HIV/AIDS on Gold Fields, to enable the company to remain globally competitive for the benefit of shareholders, employees and South Africa.

International Federation of Chemical, Energy, Mine and General Workers' Unions. To focus on workplace activities; undertake research on HIV/AIDS, including on the cost, affordability and availability of HIV/AIDS drugs and disseminate the results; cooperate with employers to fight stigmatization.

National Union of Mineworkers. To adopt with employers a joint policy and campaign to combat the spread of HIV/AIDS that includes care, counselling, support and education programmes.

ILO code of practice

The ILO code of practice *HIV/AIDS and the world of work* was adopted in June 2001. The fundamental aim of the code is to help secure conditions of decent work and protect the rights and dignity of workers and all people living with HIV/AIDS.

The code is intended to prevent the spread of the epidemic, mitigate its impact on workers and their families, and provide social protection that can help them cope with the disease. It includes practical guidance to governments, employers' and workers' organizations (as well as other stakeholders) for developing national and workplace HIV/AIDS policies and programmes.

The code addresses several important issues, including preventing infection through information, education and gender-awareness programmes, and by promoting behaviour change. It covers the protection of workers' rights (including employment protection, gender equality, entitlement to benefits, and non-discrimination on the basis of HIV status). And it deals with the challenges of care and support (including confidential voluntary counselling and testing, as well as treatment in settings where local health systems are inadequate). The text of the code can be found on the ILO's web site (www.ilo.org/aids).

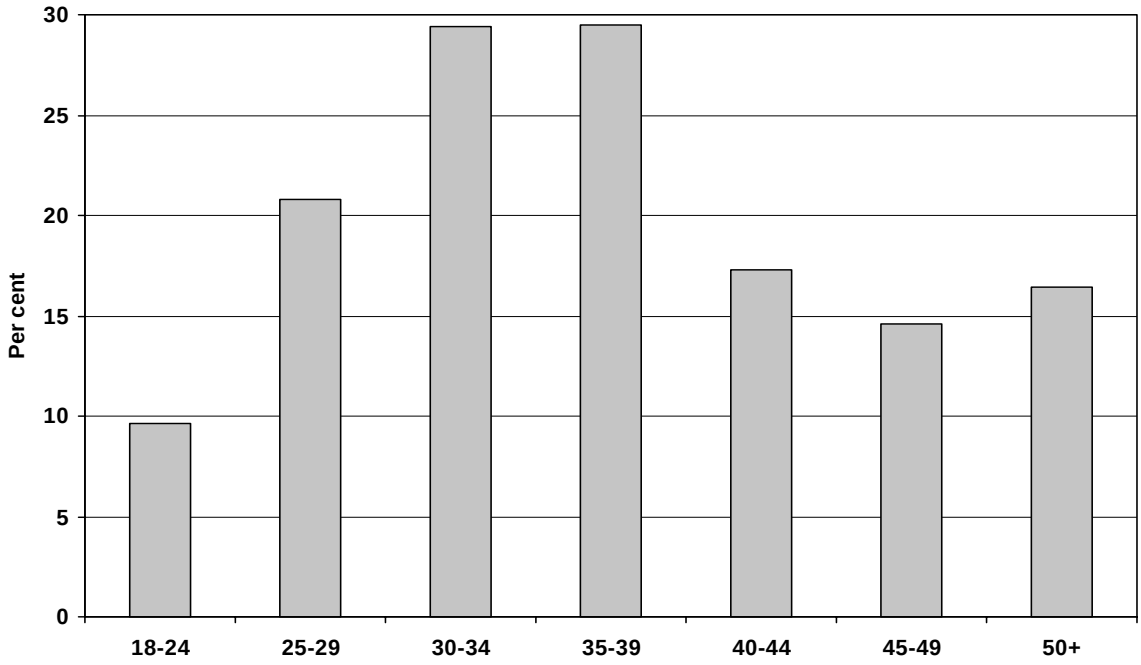
Testing: The path to data and targeted action

Companies are taking different approaches to encouraging voluntary testing programmes in their workforce. But the objectives are the same – to obtain data, encourage openness and enable appropriate action to be taken for care and support. In December 2001 Gold Fields and three mining unions entered into an agreement to launch an AIDS programme among its 50,000 workers. The programme, which focuses on education,

involves voluntary counselling and testing (VCT) and the treatment of STDs, which are a major vector in HIV transmission. [9] Anglo American Platinum obtained union agreement to begin a programme of anonymous testing of its workforce. Debswana carried out a voluntary, anonymous unlinked HIV-prevalence study at all its sites in 1999.

There was a high degree of participation in Debswana's testing programme (75 per cent), which showed HIV infections among 28.8 per cent of the workforce. At that time, the most affected group were those aged between 30 and 34 who had an infection rate of 36.9 per cent. In 2001 the prevalence rate ranged from 9.6 per cent to 29.5 per cent and the most affected group were those in the 30-39 age bracket (figure 4.2).

Figure 4.2. HIV/AIDS prevalence rates by age: Debswana, 2001

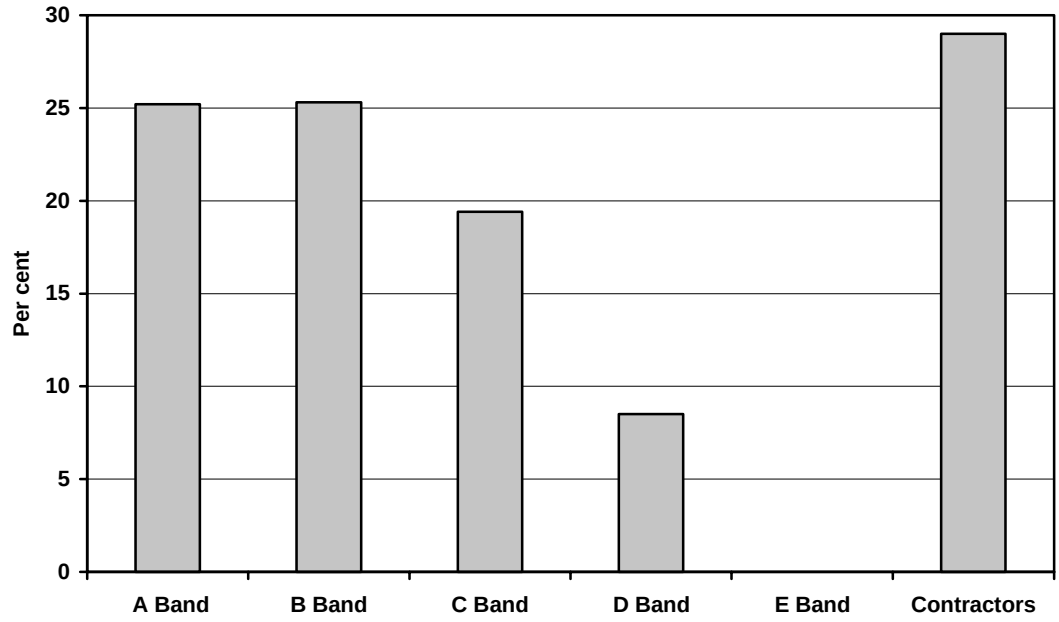


Source: Interview with Mrs. Tsetsele Fantan, Debswana.

The incidence by job category at Debswana – unskilled to senior management, and among contractors – in 2001 is shown in figure 4.3.

[9] Dr. André Bester, see footnote 1.

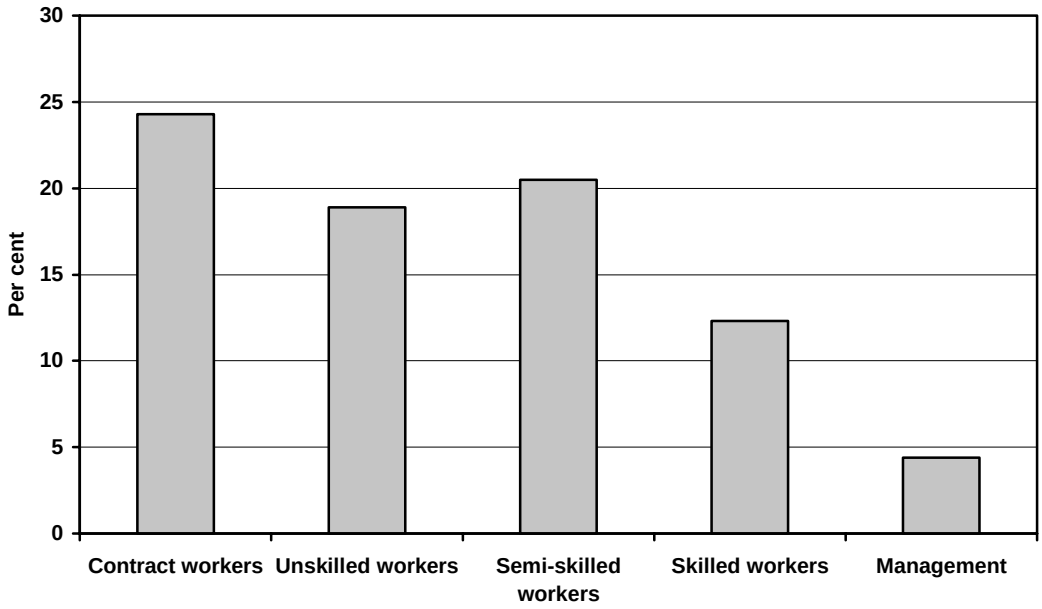
Figure 4.3. HIV/AIDS prevalence rates by skill band: Debswana, 2001



Source: Interview with Mrs. Tsetsele Fantan, Debswana.

The comparison between direct employees and contract workers is stark. This higher level of HIV incidence in contract workers is borne out in figure 4.4 which is based on a sample of over 22,000 mine employees in Botswana, South Africa and Zambia.

Figure 4.4. HIV prevalence in selected mines in Botswana, South Africa and Zambia, 2001



Source: Dr. Clive Evian: presentation at Global Mining Initiative Conference on Mining, Minerals and Metals for Sustainable Development, Toronto, 12-15 May 2002.

The widespread existence of HIV infections led Debswana to start testing all scholarship and apprenticeship candidates for 2000. As well as safeguarding the considerable investment in training, the policy is seen as a good incentive for young people to remain clear of infection – at least before entering the company. Only two of the 56 candidates aged 18-24 who were tested (after education and counselling) were positive. All of the 70 tested in 2001 were negative.

In Gold Fields, the rate of HIV infection in the workforce (age 24-54) mirrors that of South Africa as a whole for the same age group (26.4 per cent v. 27.6 per cent). The company estimates that the rate of HIV infection in its workforce will peak at about 36 per cent in 2006 and taper off to about 20 per cent by 2012.

A voluntary, unlinked HIV prevalence study was carried out by Anglo American at its Konkola copper mine in Zambia in 2001. The study, which was funded by the United Kingdom Government's Department for International Development (DFID), was undertaken with the full cooperation and agreement of the Mine Workers' Union of Zambia, the Ministry of Health, the Zambian HIV/AIDS Business Sector Project and relevant NGOs. Of the 6,135 employees and 2,388 contract personnel who were tested, 18 per cent were HIV positive. Preventive care and wellness programmes are being designed and implemented for employees and dependants with HIV to delay the onset of opportunistic infections and progression to AIDS. [10] There is no information on what action the employers of contract workers propose to take. Following the recent decision by Anglo American to sell its investment in the Zambian copper belt, it remains to be seen how and to what extent the HIV/AIDS programme will be maintained.

Education, counselling and joint company/trade union social dialogue and advocacy have paved the way for anonymous testing programmes in a number of companies. Saliva tests are quick, easy and non-invasive. In some companies, volunteers have the option of using an unmarked sample vessel or one with a number. In some cases they give their age and grade. When the results of the numbered samples are posted, individuals who are HIV-positive can remain anonymous or obtain counselling.

Wellness programmes

Wellness programmes comprise VCT and affordable and effective therapies to extend the productive life and well-being of HIV-positive employees. AngloGold has launched a programme to extend meaningful medical benefits, including preventive and curative health care, to dependants of employees.

Box 4.2 shows how an agency that is already well established in areas where mineworkers come from, can capitalize on its presence, credibility and database to branch out into new areas concerning HIV/AIDS; in this case community home-based care.

[10] Company fact sheet, 2001.

Box 4.2. Community home-based care: The Bambisanani Project

The Employment Bureau of Africa (TEBA), which was formerly the vehicle for recruiting unskilled labour for South African gold mines, is now a commercial purveyor of employment, financial and rural support services. It is the latter which has led TEBA, as a point of contact between employers, workers and their families, into providing community care. The Bambisanani Project, based in the Eastern Cape Province of South Africa, is being used by TEBA to develop a model for extending home-based health care to mineworker-sending areas. TEBA, acting as the lead agency, is in partnership with the mining industry (which provides funding), unions, government, NGOs and researchers.

Support for mineworkers with AIDS is placed within the context of the entire community in the light of the range of issues that need to be addressed, including: stigma, poverty and hardship due to the loss of economically active people, support for caregivers (particularly the elderly and the young), provision of affordable funeral services, increasing food production and the relief of pressure on health and social support services. The care of AIDS orphans was added to the programme as soon as the enormity of the problem was realized.

The main phases of the project were:

Building capacity within communities. Creating the skills that they will need in order to initiate and sustain a quality home-based care system for mineworkers and other community members with terminal illnesses. The current approach uses salaried community workers (expensive) with a view to reskilling TEBA's field workers to train and support (paid) village caregivers who in turn train and support home-based carers (who receive home-based care kits). This enables one field worker to support several hundred home-based carers.

Establishing support group activities. Infected and affected individuals and their families are serviced using drop-in centres based at hospitals, churches and local government offices. The main target groups are people living with AIDS, women (especially caregivers), bereaved families and those caring for orphans. Support for children in distress is coordinated with government health and welfare programmes, but also involves youth counsellors and peer education.

Promoting income-generating activities and services. The focus is on helping needy families establish building, food-related, farming and other small enterprises. Another element is the creation of an environment that supports community development, involving all concerned.

To encourage sustainability, participation in the programme is conditional on communities organizing and electing care supporters independently. This approach makes it more likely that the caregivers and trainers will be trusted.

Source: Ralph Elias et al.: *HIV/AIDS, the mining and minerals sector and sustainable development in southern Africa* (MMSD Southern Africa); research topic 2, 2001, p. 44.

Tackling related diseases

Addressing TB and STDs are keys to reducing the spread of HIV infection and slowing the progression from HIV to AIDS. It is estimated that a 40 per cent reduction in new HIV infections can be achieved through an active and aggressive STD management programme that focuses on communities, both near the mine and "at home" as well as on employees. HIV-positive people with active TB have a much shorter life expectancy. A vicious cycle between HIV and TB develops, with HIV increasing TB incidence rates by orders of magnitude which, in turn, greatly increases the TB infection pool particularly in self-contained mining communities. In a study that compared the incidence of TB in mineworkers who are HIV-positive and in those who are not, the former showed an incidence of TB of 8.7 per 100 person-years, 15 times that of miners who were not infected with HIV. [11]

[11] Dr. Clive Evian: presentation at Global Mining Initiative Conference on Mining, Minerals and Metals for Sustainable Development, Toronto, 12-15 May 2002.

Several companies in the BHP Billiton and Anglo American groups have an HIV prevalence in their workforce that is less than half that in the community as a whole. At BHP Billiton's ZAC colliery in Natal, for example, it is 12 per cent compared with an overall adult prevalence of over 30 per cent. If prevalence can be maintained at about 10 per cent, the effect of HIV/AIDS on company costs will be about 2-3 per cent, provided that medical costs can continue to be borne by medical aid schemes. At Anglo American's Namakwa Sands operation in Western Cape Province, the predominantly locally recruited workforce has an HIV prevalence of only 2 per cent.

Boxes 4.3 and 4.4 illustrate how a combination of initiatives is helping to contain the problem.

Box 4.3. Reducing the risk

Over the last ten years BHP Billiton has acted to reduce risk by having a policy of:

- recruiting labour locally as far as possible;
- phasing out hostel accommodation in favour of providing individual housing allowances, and by having a family-friendly environment where hostels do operate;
- placing greater emphasis on qualifications, by increasing the proportion of employees with matriculation;
- mandating participation in private medical aid schemes (from 2001).

These steps were taken in addition to the usual measures, including vigorous STD campaigns and periodic prophylactic treatment of sex workers.

Source: Ralph Elias et al.: *HIV/AIDS, the mining and minerals sector and sustainable development in southern Africa* (MMSD Southern Africa); research topic 2, 2001, p. 41.

Box 4.4. Community-based intervention among high-risk women

A survey commissioned by AngloGold in 1995 to investigate the reasons for the high HIV and STD prevalence in the mining communities around Welkom showed that the single-sex hostel system was driving extramarital sex, particularly with a core group of highly mobile sex workers. While the mineworkers had access to medical services, the women did not. The survey also identified both a lack of awareness of STDs among mineworkers and a reluctance among the women to use the services that were available due to highly judgemental attitudes among nursing staff. A programme to provide peer education and STD treatment to high-risk women was developed and implemented. The main approaches included:

- recruiting peer educators from among women at high risk;
- permanent and mobile clinics offering training, condoms and treatment;
- an anonymous card-based registration system allowimg clients to attend follow-up sessions at any treatment station and facilitating tracking.

Several important issues emerged from this intervention:

- The resident community was and still is hostile towards the core group of sex workers. This is partly because many of the women come from elsewhere, including from nearby countries.
- Some women continue to engage in sex work even when they are in stable relationships with mineworkers (so-called "town wives"), possibly unknown to the men. Such women may consider other sex workers in a negative light.
- Some owners of illegal brothels were in favour of participation since it could enhance their reputation for safety, whereas others who tended to deny their activities rejected approaches.
- The provision of preventive prophylactic treatment to sex workers is a highly cost-effective measure to address HIV transmission, educate about safe sex, and form partnerships between mining and broader communities.

Source: Ralph Elias et al.: *HIV/AIDS, the mining and minerals sector and sustainable development in southern Africa* (MMSD Southern Africa); research topic 2, 2001, box 13, p. 53 et seq.

Peer education

Education and training are important parts of every company's approach to increasing awareness and encouraging safe practices. When miners return to work after extended leave, the first part of the formal back-to-work training session is generally on HIV awareness. Condoms are readily available, from peer group trainers and dispensers at work and in accommodation areas. Gold Fields, for example, has 600 volunteer peer educators – one for 80 employees, with a target of one for every 50 employees. These volunteers take part in support groups, pre- and post-testing counselling and staffing information booths at sports days, rallies and festivals. The current take up of condoms by Gold Fields' employees is two per month. One goal of the company's HIV/AIDS programme is to increase this to three per employee per week. [12]

Lessons and challenges

Lessons

Two responses to AIDS are both wrong and unhelpful. The first is to deny the extent of the challenge that AIDS poses to society and, in some countries, to the mining industry. The second is to become defeatist and engage in apocalyptic predictions of disaster. [13] The mining industry – companies, unions, communities – is making considerable progress in countering AIDS and its impact on the workforce. It recognized early on that HIV/AIDS is a business issue, not one confined to occupational safety and health. HIV/AIDS affects workers' performance and welfare, and thus has an impact on employment, productivity and a company's bottom line – not just its financial performance; its reputation as socially responsible employer is also affected.

Identifying and focusing on key areas for risk-reduction strategies is a priority if the operational impact of HIV/AIDS is to be managed and, hopefully, minimized. It is clearly also necessary for mining companies to work closely and fully with trade unions to deal jointly with problems and develop solutions. Trade unions are the link between the company and its workforce. It is also essential to involve as broad a range of people as possible – communities, NGOs and governments at all levels.

The fact that HIV/AIDS is prevalent in the mining workforce in sub-Saharan Africa does not mean it is of no concern elsewhere. The mining industry is already global and ownership is increasingly concentrated. Capital is certainly global. A company that is not addressing HIV/AIDS adequately will find it harder to raise capital for investment in expansion or for new mines. Its workforce, increasingly connected by way of framework agreements and union alliances, may also react negatively, possibly fearing that inappropriate action in one country will be reflected in another.

It is difficult to make calculations that take into account the direct cost of infection (health care) with the indirect cost (lost production, replacement, training) and other less quantifiable effects. Much depends on the assumptions that are made about transmission and incidence. Data on past events, prevalence and days lost to sickness may not be a good guide for the future, especially if they are too conservative.

[12] Dr. André Bester, see footnote 1.

[13] *AngloGold's response to HIV/AIDS*, op. cit.

VCT centres and wellness clinics have emerged as potentially critical centres for forming partnerships between mine- and community-based activities and allowing a wider population to be reached.

Challenges for employment, working time and training

Notwithstanding the high level of AIDS awareness (over 90 per cent in many areas), a high proportion of men and women have multiple partners and do not use condoms. It remains to be seen how and to what extent knowledge can lead to changes in attitude and, more importantly, practices. It would be interesting to monitor the extent to which lessons that are instilled into new workers, such as Debswana's apprentices, are retained.

Since not all members of a community are at equal risk of contracting or transmitting STDs, including AIDS, the means to identify and reach out to high-risk groups will enable a targeted approach to prevention and treatment. Care will have to be taken not to stigmatize or ostracize those who receive prevention and care services.

A key question for all concerned is how long HIV-positive workers can remain productive and what care they should receive to enable them to keep working. The extent to which working time increases in order to boost productivity will pose problems for those who might be able to work eight hours a day, but are not able to work 12 or more. The next question is how mineworkers with HIV should be cared for, and where, when they are no longer able to work.

For any HIV/AIDS initiative to be sustainable, there must be effective community involvement, especially in prevention programmes. Attitudes and, above all, behaviour must change and the stigma of HIV/AIDS be removed. Voluntary counselling and testing, partner disclosure and enrolment in treatment programmes will prolong the useful working life of those concerned, provided that compliance with treatment is ensured – another challenge. It is in all parties' interests to prolong productive working life.

The very real risk of being killed or incapacitated at work in underground mines is likely to be far more potent a determinant of behaviour than the delayed risk from HIV infection. Behavioural change is vital to dealing with HIV/AIDS, notwithstanding the extent of cultural resistance to outside interference in social and sexual behaviour.

Recruitment and training costs will escalate with the loss of skills and experience as the rate of absence and the need for replacements and for additional, wider and more specialized training increases. The median period of time between infection with HIV and death is 14-20 years in industrialized countries. In Africa it is only six to eight years. Untreated, death occurs 12-24 months after the onset of AIDS. A study in 1998 suggested that, such is the speed at which HIV evolves into AIDS in southern Africa, 64 per cent of workers who are currently infected with HIV would die within five years. In ten years from the baseline, 85 per cent would be dead. [14]

Social dialogue and HIV/AIDS

The successful implementation of an HIV/AIDS policy and programme requires cooperation and trust between employers, workers and their representatives and

[14] La Grange, op. cit.

government, where appropriate, with the active involvement of workers infected and affected by HIV/AIDS. [15]

In the light of the rush to address HIV/AIDS, particularly by outside agencies, coordination of effort and approach is important if resources are not to be wasted. While the top management of major companies is clearly committed to addressing the problem, there would seem to be a need for greater coordination, especially among smaller companies, notwithstanding the major role already being played by chambers of mines. Social dialogue can help to ensure that issues are discussed and addressed in the most appropriate way.

Mining companies and unions will have to continue to focus on how to reconcile the fundamental need to maintain productivity in very competitive circumstances with the desire to maximize lifelong benefits without disadvantaging workers. Well-established mechanisms for social dialogue will be important for success.

[15] ILO: *HIV/AIDS and the world of work*, ILO code of practice (Geneva, 2002), p. 7.

5. Mining and sustainable development [1]

The MMSD project

At the time of writing, *Breaking new ground*, the report of the Mining, Minerals and Sustainable Development (MMSD) project had just been circulated. In view of the significance of this project for the mining industry and its impact on outreach and future activities, it is appropriate to present briefly some of the background, issues and proposals that were on the table.

By the time this sectoral meeting takes place, a conference organized by the Global Mining Initiative – Resourcing the future: Mining, minerals and metals for sustainable development – will have been held (Toronto, 12-15 May 2002) and the World Summit on Sustainable Development (Johannesburg, 26 August-4 September 2002) will recently have finished. But these events will merely be precursors to the development of a range of new relationships, partnerships, compacts and agreements on different aspects of mining and sustainable development, including those surrounding decent work, that concern the ILO and its constituents.

The objectives of the MMSD project, which was carried out at the International Institute for Environment and Development (IIED) were to:

- assess the global mining and minerals sector in terms of the transition to sustainable development;
- identify how the services provided by the minerals system can be delivered in accordance with sustainable development in the future;
- propose key elements for improving the minerals system; and
- build platforms of analysis and engagement for ongoing cooperation and networking among all stakeholders.

The project was sponsored (with cash and in-kind contributions) by over 40 organizations, including about 30 mining companies, governments, international organizations and non-governmental organizations. An independent assurance group was established to review progress and advise on future direction throughout the project. The report, which was a consolidation and synthesis of what has been done and what was known by others, was intended to be a beginning for those involved in mining and minerals who wanted to move forwards.

The following information from *Breaking new ground* focuses on the issues surrounding decent work in the mining industry that are of particular relevance to the ILO and its constituents. The purpose is to explore how best to ensure that the engagement, intentions and promises to address these issues that have been made as a result of the MMSD project and its aftermath can be carried forward, through social dialogue, where

[1] This chapter draws extensively on sections of the report of the MMSD project: *Breaking new ground: Mining, minerals and sustainable development*, published online on 1 May 2002 (www.iied.org/mmsd/finalreport). It will be available in its final published form from Earthscan Publications in July 2002.

appropriate under the umbrella of the ILO, so that mining can provide decent work and contribute to sustainable livelihoods.

Making a positive contribution

If the mining sector is to contribute in a positive way to sustainable development it needs to demonstrate continuous improvements in its social, economic and environmental contribution, with new and evolving governance systems. Box 5.1 provides a framework based on a set of guiding principles for each of these dimensions.

Box 5.1. Sustainable development principles

Economic sphere

- Maximize human well-being.
- Ensure efficient use of all resources, natural and otherwise, by maximizing rents.
- Seek to identify and internalize environmental and social costs.
- Maintain and enhance the conditions for viable enterprise.

Social sphere

- Ensure a fair distribution of the costs and benefits of development for all those alive today.
- Respect and reinforce the fundamental rights of human beings, including civil and political liberties, cultural autonomy, social and economic freedoms, and personal security.
- Seek to sustain improvements over time; ensure that depletion of natural resources will not deprive future generations through replacement with other forms of capital.

Environmental sphere

- Promote responsible stewardship of natural resources and the environment, including remediation of past damage.
- Minimize waste and environmental damage along the whole of the supply chain.
- Exercise prudence where impacts are unknown or uncertain.
- Operate within ecological limits and protect critical natural capital.

Governance sphere

- Support representative democracy, including participatory decision-making.
- Encourage free enterprise within a system of clear and fair rules and incentives.
- Avoid excessive concentration of power through appropriate checks and balances.
- Ensure transparency by providing all stakeholders with access to relevant and accurate information.
- Ensure accountability for decisions and actions, which are based on comprehensive and reliable analysis.
- Encourage cooperation in order to build trust and shared goals and values.
- Ensure that decisions are made at the appropriate level, adhering to the principle of subsidiarity where possible.

Breaking new ground suggests that to meet the sustainable development imperative, mining companies need to go beyond their traditional responsibilities to employees, shareholders and regulators. A move towards sustainable development involves meaningful partnerships with local communities and government, effective and productive ways of working with NGOs, enhanced stakeholder participation, integrated life-cycle planning, transparency, forward-looking preventive action, timely remedial action, regulatory compliance, a respect for declared "no-go areas", and investment in the future to provide for well-being in a more sustainable world.

A key challenge for implementation is the development of integrated tools that are, inter alia, feasible, transparent, credible, reliable and reproducible. Meeting these criteria will require more and better consultation and commitment at the highest levels between employers' and workers' organizations, as well as with other actors. Better integration, collaboration and accountability in a global industry can be enhanced if there is comparable data. Having a firm base to build on, such as the ILO, for example, should both speed up the process and augment trust and cooperation between the social partners concerned with the mining industry.

Challenges and benefits

There are many challenges, including social and labour challenges, facing the mining sector as it moves towards embedding sustainable development as a strategic objective. These include, firstly, ensuring the viability of the industry. This requires, inter alia, a safe, healthy, educated and committed workforce as well as the ability to attract and maintain good management talent. A second important challenge is to address the links between local communities and mines. Recent trends towards smaller workforces, outsourcing and new work organization (see Chapters 1 and 2) can have an adverse effect on mining communities. Ensuring that improved health and education or economic activity will endure after mines close requires a level of planning and action that has too often not been achieved.

Third, access to information is a key to building greater trust and cooperation, not least between management and the workforce, but also beyond the mine gate. The quality of information and its use, production, flow, accessibility and credibility affect the interaction of all the mining sector's actors.

Fourth, sustainable development requires new integrated systems of governance. Voluntary codes and guidelines – such as those of the ILO in the safety and health and other labour-related spheres – can play an important role in addressing problems while the frameworks and practice of governance are being strengthened through social dialogue.

But there are also commercial business benefits to be had from addressing sustainable development concerns. These include:

- **Lower labour costs and more innovative solutions**. Providing good working conditions can improve motivation and productivity, result in fewer industrial disputes, and reduce absenteeism and labour turnover.

- **Lower health costs**. A healthy work environment and a healthy community improve well-being, which translates into higher productivity, reduced worker and community compensation and damage suits, and reduced costs for social services, medication and treatment.

- **Cost savings due to cleaner production methods and innovation**. Reducing raw materials use and increasing recycling and recovery can lower production costs. Innovation and technology, accompanied by appropriate training, can introduce new process and product efficiencies.

- **Higher value for goodwill on the balance sheet**. A commitment to sustainable development may enhance a company's profile and reputation. It will help to attract the best people to join the company, and to keep them. Externally, it could improve its social licence to operate, particularly with a skilled and satisfied workforce as advocates. Many people who are happy enough to use the final products of mining do not like the holes in the ground they came from.

- **Best practice influence on regulation**. Companies that follow best practice are better placed than their competitors who do not influence how standards are set and the direction of regulatory change.

Work-related issues

Sustainable development requires openness and transparency in information production and dissemination throughout the minerals life cycle. The processes by which the information is generated and communicated play a key role in improving all participants' ability to negotiate effectively and with legitimacy. Enabling access to information and its analysis has implications for training, including of the mining workforce.

Attracting and retaining high-calibre employees is essential to the mining industry's continued viability and to its ability to contribute to sustainable development. Mining companies will find it difficult to attract high-calibre people if the industry is seen as offering poor future job prospects, a negative image, and for certain categories of employees constant moves and disruption of family life. In addition, the industry has often done a less-than-optimal job to date in diversifying its workforce, particularly in professional jobs.

Breaking new ground states that mining has a poor record of safe and healthy and working conditions. Notwithstanding significant progress in most countries in recent years, more needs to be done to ensure that mineworkers can work without injury or illness. The report points out that: "… Effective safety management on a day-to-day basis requires partnership among management, workers and unions. Companies need to demonstrate that they are meeting the minimal standards required under the International Labour Organization core Conventions, including the right of workers to choose to form trade unions and the observation of minimum standards for health, safety and hours of work." The report notes that miners' rights are threatened by difficult and dangerous working conditions.

While progress has been made towards the uniform reporting of accidents, there is no uniformity in the reporting of occupational diseases in mining. Benchmarking will encourage best practice and help in determining occupational exposure limits. The report suggests that a common set of standards on reporting and exposure limits should be developed through a multi-stakeholder process convened by an international organization such as the ILO. In this context it is important to note here that at the 90th Session of the International Labour Conference in June 2002 a Protocol to the Occupational Safety and Health Convention, 1981 (No. 155), concerning the recording and notification of occupational accidents and diseases was adopted, together with a Recommendation concerning the revision of the list of occupational diseases, Schedule I to the Employment Injury Benefits Convention, 1964 (No. 121) and a mechanism for regularly updating the list. [2]

The approach to health should not, however, be solely concerned with reducing injury and illness; it should embrace a positive concept of well-being. Community health and worker health are related – disease can spread quickly to and from the workplace. Consequently the sector needs to research the effects of trends in employment patterns

[2] ILO: *Provisional Record* Nos. 24A and 24B, International Labour Conference, 90th Session, Geneva, 2002.

before the effects are felt. As the chapter on HIV/AIDS above shows, the mining industry is at the forefront in addressing such issues in a number of countries.

The ILO could also play a role concerning indigenous peoples. Control, management and autonomy over land are a core interest of many indigenous cultures. If a mining company acts under national laws that do not recognize indigenous rights, and attempts to operate in indigenous areas, conflicts are likely to arise. Prior informed consent arrived at democratically, taking into account the relevant provisions of the ILO's Indigenous and Tribal Peoples Convention, 1989 (No. 169), may be an appropriate model for indigenous communities. But successful implementation will require cooperation from governments. The ILO can provide guidance and practical assistance concerning the scope and implementation of this Convention.

Breaking new ground stresses the need to ensure that the benefits from minerals development are sustained beyond the life of the mine, including taking the necessary action to meet the concerns of workers who lose their jobs. Such efforts will be of limited success if they are initiated without social dialogue and only when retrenchment is a reality.

Social dialogue and sustainable development

Forging alliances will enable the social partners to have a joint approach to addressing the broader sustainable development issues such as environment, recycling, land use. If the social partners are not in step success will not be assured. Moreover, any progress that is made is likely to be incidental, difficult to achieve and transitory rather than sustainable. Structured social dialogue that ensures access to information offers the best prospects for ensuring decent work in the mining industry and, through that, the pathway to sustainable livelihoods and development. Social dialogue can also be a means to increase the capacity of the actors involved in mining.

The MMSD report calls for the establishment of several policies, mechanisms, codes and facilities to address all aspects of sustainable development that involve mining and minerals. For example, for the industry the report recommends a commitment to a sustainable development code; a complaints and disputes resolution mechanism; and a sustainable development support facility. For workers' organizations, in view of their critical role in assisting the mining and minerals sector to improve its contribution to social and economic development objectives, the report recommends a global labour/industry agreement on sustainable development with greater involvement by workers and their organizations in training and health and safety as well as in community-level activities. The agreement could be linked to counterpart agreements at the national and local levels. Governments are encouraged to develop a strong policy and regulatory framework for sustainable development that includes planning for mine closure, rehabilitation, guaranteeing financial surety – each of which is important for employment – and increasing the capacity of its own organs.

The MMSD report highlights the role that intergovernmental organizations can play in a number of areas, including capacity building, convening the concerned parties for comprehensive discussions, facilitating a more coherent approach among their constituents, and developing credible programmes for sustainable development that would attract support from other donors.

The report suggests that ongoing social dialogue on mining, minerals and sustainable development could be established through a forum that could stay in effective communication with the principal stakeholders. If such a body were established, it would

have to be truly representative, have a clear role, be housed, financed, and fully supported by its members. Several options are canvassed. Consideration should be given to what role the ILO and its tripartite structure of governments, employers and workers' organizations could play in such a body.

6. Summary and suggested points for discussion

Summary

Employment

Employment in the mining industry is changing in several ways for a variety of interrelated reasons: commercial, political, technological, demographic and social. The net effect, despite rising production, has been a steady fall in the number of people employed in mining, an industry that accounts for less than 1 per cent of the global workforce. Well over 3 million jobs have been lost in the past five years.

So what of this leaner, more productive workforce? How is the mining industry coping? Several factors stand out. The increased use of contract workers throughout the industry, including in production in some cases, means that such workers do not show up in the data of the mining company, although they are generally included in global figures. The workforce is ageing – as is the workforce generally – but in mining it seems to be occurring faster and from a higher average age to start with in many countries. The mining industry is still typically an employer of increasingly higher-skilled men on a predominantly full-time basis; any increase in the employment of women in the mining workforce is sporadic and mostly from a low base. On the other hand, the loss of jobs in mining does not appear to have affected women to any greater extent than men; their level of representation in the workforce has not fallen. There has been some increase in the proportion of employees engaged in production and processing activities, as opposed to non-production-related work.

Although recent employment changes in the mining industry might not everywhere have been quite as dramatic as in Central and Eastern Europe and the former Soviet Union, they have been substantial and sustained over the past ten to 15 years, driven by the intense competition in the international minerals markets, including as a result of mergers and acquisitions. Nonetheless, while mining employment has stabilized in some countries and is even increasing in a few, there are likely to be further reductions in the mining workforce over the next five to ten years.

Two foundations – trust and information – underpin all restructuring programmes that involve reductions in employment. All too often, however, they are not introduced until the process is well under way, rather than when the first signs are evident. The outcome is then generally unfortunate – for the industry, its workers and their families, and for the government agencies concerned.

Working time

The pressure for changes in working-time arrangements is widespread and growing, not least as global companies seek to maximize their returns across their operations. Changes in working time have implications for occupational safety and health, productivity and quality of working life, as well as for social, family and community relations. Not all of these appear to have been sufficiently explored or given enough weight.

Clearly, in the context of the contribution of mining to sustainable development, it behoves employers, workers and their organizations, and regulators, to examine fully the social and labour impact of longer working hours, including at the community level.

As might be expected, there are positive, neutral and negative outcomes from studies and research on extended workdays in mining. The reasons for a lack of consistency include the measures used, the type of work done within the shift and the motivations and biases of the experimenters and subjects. Moreover, the consequences of introducing extended workdays are site-specific. For example, the degree to which management stresses safety, prior agreement, cognitive or physical workload, average age of the workforce, commuting time, training and counselling can affect the outcome of extended workdays.

While there will continue to be debates about the influence particular rosters and their design have on the impact of shift work, there is now widespread acceptance that shift work is itself a biological and social disruptor that creates hazards and difficulties.

The problem of shift work is not just a biological clock problem, a sleep problem, or a social problem. It is a complex interaction of all three. The sooner this is recognized, the sooner education programmes can be developed and implemented to assist those who are not coping well. Such programmes need not involve radical changes in the enterprise's work organization but they can reap benefits in terms of safety, employee satisfaction, absenteeism and turnover.

The combined effects of shift work and workplace environment in mines, such as noise, heat, dust, hard physical work, ergonomic issues and the effect of each, appear to require further study. This would seem to be particularly relevant where long shifts or many shifts in a row are worked.

Factors that affect shift work 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 issues 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. Their development cannot be achieved at an individual employer/employee level; it requires effective social dialogue and the articulation of needs amongst the social partners.

Improvements in the design and operation of equipment and technology have tended to be well ahead of improvements in the human factors that are necessary for their efficient and continuous operation. In addition to having a highly competent workforce in terms of skill level, training and experience, it is imperative to have people who are alert and fit for duty.

Fatigue and human error are primarily the consequence of inappropriate practices. Employees who exceed prescribed alcohol limits are generally prohibited from working, whereas a worker who has been awake for 18 hours or more shows the same symptoms but faces no such barriers. Unless the problem of fatigue is directly addressed, it will continue to generate high costs.

Properly designed and monitored scheduling practices, appropriate workplace design and employee selection procedures, and adequate training and counselling programmes

that are developed and implemented through social dialogue can reduce the effects of stress and fatigue. They would seem likely to achieve a high return on their investment.

The difficulty for both management and workers' organizations with respect to fatigue is that both have been involved 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 workers' organizations and their members they have underpinned lifestyles based on anticipated income, even if at some personal and social cost. Moves towards a more deregulated and individualized system of industrial relations and occupational safety and health point to a challenge for regulators in formulating the duty of care and assessing its impact on the design of working-time arrangements.

Changes in employment relationships, together with changes in work practices, that have occurred in many countries in the last decade or so seem to have outpaced or blurred the impact of checks and balances, such as legislation and regulation, accountability, exposure limits, research and data collection and analysis. These need to be focused on so that the economic and social benefits of new work practices that entail compressed working time and extended shifts are considered together, and such work patterns do not turn out to be a poisoned chalice for workers, their families, the mining industry and society at large some years in the future.

In view of the occupational safety and health concerns associated with working time, it would seem useful if working-time data were collected and made available on a more systematic basis to enable a full investigation into the nature and extent of any causal relationship between hours of work, including overtime, and occupational accidents and diseases that might exist.

Training

The need for sound basic skills in the mining workforce, as in other industries, is clear. They include literacy, numeracy and broader problem-solving and teamwork skills. Broader basic skills and specialized skills programmes should complement rather than compete with each other, and training should include broader skills and needs, such as human relations, communications and workplace safety and health. There is a question of the extent to which information and communication technology is appropriate in developing countries compared with the need to focus on the initial stages of education. While this might be true at school, at the workplace the best mix of methods to impart effective training should be assessed and used. The workplace is becoming a major source of lifelong learning – from apprenticeship through to pre-retirement and pre-retrenchment training. Many new "soft skills", such as teamworking, initiative and communication skills that are increasingly demanded in flatter, more flexible work structures, are better learnt at work.

It is in the interest of both employers and workers in the mining industry to have appropriate instruments for the evaluation and recognition of competencies acquired through work experiences. There are several examples of tripartite national or industry-specific structures of qualifications that either manage the validation process or monitor validating organizations. Qualifications structures can facilitate lifelong learning and help match skills demand with supply, including in internal company markets.

The move towards flatter structures has shifted responsibilities closer to the workforce. This should be taken into consideration as far as training and remuneration are concerned. Provided that skills and competencies can be fairly measured and tested, it should not matter where they were acquired when they are being considered for

certification. In some countries, competency-based assessment techniques have established systems to recognize these skills, irrespective of where they were acquired.

The rural source of much of the mining industry workforce in southern Africa and elsewhere has meant there is a strong need for broadly based rural development agencies to provide advice and assistance to enable people to earn a livelihood beyond mining. The repositioning of relevant agencies towards development and finance activities has been an important factor in ensuring as smooth a transition as possible to a productive life beyond mining. Elsewhere, the recruitment of migrant workers, including highly skilled ones, is becoming more common. This leads to the need to put special emphasis on language and communication training.

The pursuit of learning and training for work is a shared endeavour. Depending on the objectives, the social partners and individuals have distinct responsibilities. It is through social dialogue that all concerned can defend their interests, participate in policy-making, and share in the investments for learning and training. Partnerships between government, the social partners, enterprises and civil society increase the effectiveness and resource base, and improve the equity of outcomes of learning and training programmes.

The make-up of the mining workforce is changing and it will continue to evolve. Training will therefore have to be adjusted accordingly, including to take account of the need to recruit and train workers from non-traditional sources, reconciling the training needs of experienced but older miners with those of younger, inexperienced ones, and seeking the most cost-effective training materials that meet specific needs in an efficient and lasting way.

HIV/AIDS: A cross-cutting issue

The median period of time between infection with HIV and death is only six to eight years in Africa. Untreated, death occurs 12 to 24 months after the onset of AIDS. Such is the speed at which HIV evolves into AIDS in southern Africa that almost two-thirds of workers who are currently infected with HIV could die within five years; in ten years about 85 per cent could be dead.

Notwithstanding the high level of AIDS awareness (over 90 per cent in many areas) in the mining industry in southern Africa, a high proportion of men and women have multiple partners and do not use condoms. It remains to be seen how and to what extent knowledge can lead to changes in attitude and, more importantly, practices among mineworkers and their partners. It would be interesting to monitor the extent to which lessons about HIV/AIDS that are instilled into new workers are retained.

Since not all members of a mine community are at equal risk of contracting or transmitting STDs, including AIDS, the means to identify and reach out to high-risk groups will enable a targeted approach to prevention and treatment. Care will, however, have to be taken not to stigmatize or ostracize those who receive prevention and care services.

Coordination of effort and approach in addressing HIV/AIDS is important if resources are not to be wasted. While the top management of major mining companies and the trade union movement are clearly committed to addressing the problem, there would seem to be a need for greater coordination, especially among smaller companies, notwithstanding the major role already being played by chambers of mines.

A key question for the mining industry is how long HIV-positive workers can remain productive and what care they should receive to enable them to keep working. The extent

to which extended working time is introduced will pose problems for those who might be able to work eight hours a day, but are not able to work 12 or more. The next question is how mineworkers with HIV should be cared for, where and for how long, when they are no longer able to work. Mining companies and workers' organizations will have to continue to focus on how to reconcile the fundamental need to maintain productivity in very competitive circumstances with the desire to maximize lifelong benefits without disadvantaging workers.

For any HIV/AIDS initiative to be sustainable, there must be effective community involvement, especially in prevention programmes. Attitudes and, above all, behaviour must change and the stigma of HIV/AIDS be removed. Voluntary counselling and testing, partner disclosure and enrolment in treatment programmes will prolong the useful working life of those concerned, provided that compliance with treatment is ensured.

Mining and sustainable development

The report of the Mining, Minerals and Sustainable Development Project, the Global Mining Initiative Conference on Mining, Minerals and Metals for Sustainable Development, and the World Summit on Sustainable Development have identified the challenges and opportunities and some of the processes to drive forward the debate on the role of mining in sustainable development. Past examples show that left to itself and to chance progress will be slow or stall. The next stages are in the hands of those concerned, particularly the governments, employers' and workers' organizations that make up the mining industry. Since these actors are also the ILO's constituents, they could use the Organization as both platform and framework for developing, advocating and implementing the activities, including a proposed sustainable development code. The idea is to ensure that the mining industry demonstrates its willingness to improve its performance in relation to sustainable development in a steady and effective way that incorporates the needs of its primary stakeholders – mining companies and mineworkers.

Suggested points for discussion

- How can governments, employers and workers' organizations best identify and manage the mining industry's employment needs for permanent and contract workers so that recruitment, retention and separation occur in an equitable manner?

- What action should governments, employers and workers' organizations take to identify, analyse and manage the effects of existing and proposed working-time arrangements on enterprises and their workforce?

- How should governments, employers and workers' organizations collaborate to identify and meet the future skill requirements of the mining industry, taking into account demographic, organizational and technological changes?

- What lessons can be learnt from the mining industry's progress in dealing with HIV/AIDS? What action should governments, employers and workers' organizations take to ensure that HIV/AIDS in the mining industry is appropriately integrated into employment, working time and training policies and programmes?

- How should governments, employers and workers' organizations contribute to ensuring that the role of mining in sustainable development is developed, recognized and promoted in the context of decent work?

- What should be the priority areas for ILO action, in particular in research and technical cooperation, to further the Decent Work Agenda in a sustainable environment by addressing employment, working time and training issues in the mining industry?

Bibliography

African Mining (Johannesburg), various issues.

Bulletin of European Studies on Time (Dublin, European Foundation for the Improvement of Living and Working Conditions), various issues.

Chamber of Minerals and Energy of Western Australia: *Shiftwork and occupational health and safety in the Western Australian mining industry: Guidelines for workers and management* (Perth, 1998).

Coal Age (Overland Park, Kansas), various issues.

Construction, Forestry, Mining and Energy Union, Australia: *The Australian black coal industry*, unpublished study prepared for the ILO, 2002.

Elias, R. et. al: *HIV/AIDS, the mining and minerals sector and sustainable development in southern Africa* (MMSD Southern Africa), Research topic 2, 2001.

Heiler, K.; Pickersgill, R.; Briggs, C.: *Working time arrangements in the Australian mining industry: Trends and implications with particular reference to occupational health and safety*, Sectoral Activities Programme Working Paper, No. 162 (Geneva, ILO, 2000).

ILO: *HIV/AIDS and the world of work*, ILO code of practice (Geneva, 2002).

–: *Learning and training for work in the knowledge society*, Report IV(1), International Labour Conference, 91st Session, 2003 (Geneva, 2002).

–: *Encyclopaedia of Occupational Health and Safety* (Geneva, 1998).

International Coal Report (London), various issues.

International Institute for Environment and Development: *Breaking new ground: Mining, minerals, and sustainable development* (London, 2002) (www.iied.org/mmsd/finalreport).

Mines Occupational Safety and Health Advisory Board: *Fatigue management for the Western Australian mining industry: Guideline* (Perth, Department of Minerals and Energy, 2000).

Mining and Resources Contractors Safety Training Association: *Fact sheets for shiftworkers* (Perth, 1997).

Mining Journal (London), various issues.

Paździorek, G.; Gwózdź, M.: *Restructuring of Polish mining: Selected issues*, unpublished study prepared for the ILO, 2002.

Peelish, M., RAG American Coal Holding, Inc., unpublished study prepared for the ILO, 2002.

Petrova, T., Ministry of Labour and Social Policy of Ukraine, unpublished study prepared for the ILO, 2002.

Rosa, R.R.; Colligan, M.J.: *Plain language about shiftwork, DHHS* (NIOSH) Publication No. 97-145 (Cincinnati, U.S. Department of Health and Human Services, 1997).