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Prologue

Ladies and Gentlemen,

This special issue of the Transactions is published on the occasion of the 3rd International Scientific Conference “Safety Engineering 2012” organised by the Faculty of Safety Engineering of VŠB - Technical University of Ostrava in co-operation with the Czech Technology Platform on Industrial Safety. The Conference is part of celebration of the 10th anniversary of the Faculty of Safety Engineering of VŠB - Technical University of Ostrava. The Conference objective is to exchange the latest knowledge and experience between foremost specialists in the area of safety engineering. The Conference programme only consists of invited scientific papers of significant specialists from 11 countries of the world co-operating with the Faculty.

The current issue of the Transactions is composed of papers presented at the Conference “Safety Engineering 2012”. At the Conference, which is held in an attractive locality of Lower Vítkovice for the first time, current development in fire protection, major accident prevention and occupational safety is presented by leading specialists from top research institutions, e.g. Dr. Janis Jansz, Director of WSO International Office for Australia, who is, among other matters, a 2001 WSO Award winner and is one of the most prominent world personalities in the area of safety education. Furthermore, by Prof. Hans Pasman, one of the foremost world specialists in the area of risk analysis, Mr Olivier Salvi, Secretary General of European Technology Platform on Industrial Safety, and many others.

The Conference “Safety Engineering 2012” is aimed at exchanging experience between leading world and Czech specialists and simultaneously at offering the professional public and university students an interactive programme in the multifunctional auditorium Gong in the Lower Vítkovice Area, an attractive national cultural heritage site.

I believe that this Conference will contribute to the further development of scientific co-operation between the Faculty of Safety Engineering of VŠB - Technical University of Ostrava and foremost specialists.

Pavel Poledňák
Editor-in-Chief

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HEALTH & SAFETY PRACTICES IN THE WESTERN AUSTRALIAN MINING INDUSTRY

Janis JANSZ¹

Research article

Abstract: This article traces the history of health and safety practices in the Western Australian mining industry from the mining performed by the Aboriginal people to the mining industry work in 2012. It identifies the success strategies that have made the Western Australian mining industry a world leader in having a high standard of workplace health and safety practices.

Key words: Western Australian mining industry, Occupational Safety and Health, Education.

Introduction

The first miners in Australia

The word 'Aborigines' comes from the Latin words *ab origine* which mean 'from the beginning'. In Australia it is thought that the original human inhabitants were a small stature (less than 1 ½ meters tall), dark skinned, curly haired, Negrito race that are called the Barrinean people. These Negrito people came from Asia (India, Burma, Thailand, Cambodia and Vietnam) in 2 waves of migration. The first group were known as the Kartan cultural group as they were first identified on the island of Karta (which is now called Kangaroo Island). The second group to migrate are called the Targangan cultural group as they were first identified on the island of Tartanga in the Murray River in South Australia. This Negrito race of people still lives in the Atherton tableland jungles of northern Queensland. They were common in Tasmania when the first European settlers came to Australia (Tindale and George, 1973).

The next wave of settlers to come to Australia was a race of fair skinned, medium build, people with straight hair who came from Asia. This race of people is called the Murrayian. They were given this name by the European settlers as this race of people was first found to be living along the banks of the Murray River. The Murrayian people mainly lived in the southern parts of Australia and took their land from the Negrito race of people. The Murrayian race of people is thought to be related to the Ainu Aborigines of Japan. The next wave of people to settle in Australia was the Carpentarians. This race of people came from Asia. They are tall, thin, have

dark brown skin, curly hair and settled in the land in the northern parts of Australia. The Carpentarians are thought to be related to the Veddas people of Sri Lanka (Tindale and George, 1973).

Collectively the Barrinean, Murrayian and Carpentarian people in Australia are called Aborigines. The three distinct races of people were conformed in 1938 through the research work of J. Birdsell of Harvard University in the United States of America and Norman Tindale from the South Australian Museum and the University of Adelaide in South Australia. Together these two researchers made a detailed analytical study of the racial characteristics of Aborigines in Australia at over 100 field stations. When Captain James Cook came to Australia in 1770 there were some 590 separate Aboriginal Tribes, each with their own language, customs, beliefs and home land. Family groups, of 15 to 40 people, (called a horde), joined together as a group to form a tribe of related people. Each tribe usually had at about 500 members (Tindale and George, 1973).

From when they first arrived in Australia the Aboriginal people were miners. Ownership of each mine rested with the horde of people on whose land the mine was located. Access to each mine was only allowed if the land owners gave permission. The main items mined were rocks and ochre. Ochre is iron oxide that is used for religious ceremonies and for art works. The rocks mined were used to make implements to gather, or kill, or to store food. Rocks mined included "amphibolite, andesite, basalt, blue metal, chalcedony, chert, diabase, granite, greenstone, greywacke, ironstone, limestone, mudstone, obsidian, porphyry, quartz,

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quartzite, sandstone, silcrete, silicified stone, siltstone and trachyte" (Mineral Resources, 2007). Certain members in each horde were provided with education on how to correctly and safely extract the resources from their mine. At this time worker safety and health in the mining industry was both an individual and a horde responsibility. Aboriginal people were the first professional miners in Australia (Mineral Resources, 2007).

In some parts of Australia mining was women's work. For example "Ochre from near Mount Rowlands in Tasmania was mined by Aboriginal women using stone hammers and wooden chisels. The ochre was then packed in kangaroo-skin bags for transport" (Mineral Resources, 2007).

In other parts of Australia the miners were men. For example:

The Wilgie Mai mine east of Geraldton in Western Australia was a major operation with a mining face of between 30 and 15 metres wide and up to 20 metres deep. The red and yellow ochre from the mine was excavated by men using heavy stone mauls and fire-hardened wooden wedges up to half a metre long. Pole scaffolding was erected for working at different heights. Several thousand tonnes of rock were removed from this mine. Wilgie Mai is considered 'a place of fabulous wealth' by Aborigines in the west and ochre from the mine was used in a huge area of Western Australia and may have been carried as far as Queensland (Mineral Resources, 2007).

Aboriginal miners were important people of their horde and minerals trade was essential to the economy of the tribe. Most of the Aboriginal mines were open cut. There were a few underground mines, such as the flint mine at Koonalda in South Australia that extends 75 metres below the surface and up 300 metres from the entrance of a cave. In 2007 the New South Wales Department of Primary Industries had a record of 416 Aboriginal mines in Queensland, New South Wales and Victoria (Mineral Resources, 2007).

The Aboriginal population in 1770, when Captain Cook arrived in Australia, was about 300,000 people. On 30th June 2006 (the latest census information available) the Australian Bureau of Statistics (Australian Bureau of Statistics, 2010; Australian Bureau of Statistics 2012) reported that Aboriginal people were 2.5% of the Australian population and numbered 517,000 people. Of this population of Aboriginal people 32% lived in major cities, 43% lived in country towns and 25% lived in remote areas. The Chamber of Minerals and Energy of Western Australia records that in Western Australia in 2012 Australian Aboriginal people make up 4.2% of the mining industry work force

(i.e. there are 3,816 Aboriginal male and female mine workers).

Materials and methods

Recent mining activities in Australia

The next wave of settlers to come to Australia was people from Britain. On 13 May, 1787, eleven ships, carrying about 1,530 people (736 convicts, 17 convicts' children, 211 marines, 27 marines' wives, 14 marines' children and about 300 officers and others) under the command of Captain Arthur Phillip, set sail for Botany Bay in New South Wales, Australia. A few days after arrival at Botany Bay the new arrivals from Britain moved to Port Jackson where a settlement was established at Sydney Cove on 26 January 1788 (Frost, 2011). These people were not miners. A reason for this was that English law (which ruled these settlers) demanded that any gold or silver found became the property of the Crown (English Monarch). Unlike the Aboriginal people of the time these settlers could not profit from mining or mineral finds.

Unlike some other parts of Australian, South Australia had free settlers, not convicts, as European settlers. The first mining by people of European decent in Australia occurred in South Australia. In South Australia in 1841 lead was first mined in the Glen Osmond Hills. In 1842 copper was first mined at Kapunda and in 1945 at Burra Burra in South Australia (Australian mining history, 2012).

In 1840 many people of European decent left New South Wales to go to California in the United States of America to mine for gold. To reverse this trend of European decent settlers leaving Australia the New South Wales government offered a reward for the discovery of payable gold in Australia. The reward was claimed in 1851 by Edward Hargraves (5,000 pounds), John Lister (500 pounds) and William Tom (500 pounds). From this time onwards miners in Australia were allowed to keep the profits from their mining work and mining became an important industry in Australia (Australian mining history, 2012).

The first commercial mining in Western Australia began in 1898 with coal mining at Collie. This was followed in 1891 by gold mining in the Murchison district; in 1892 by gold mining at Coolgardie and in 1893 by gold mining in Kalgoorlie. In 1943 large scale mining of asbestos began at the Wittenoom Gorge. In 1951 iron ore mining at both Koolan and Cockatoo Islands commenced in the north of Western Australia. In 1953 oil mining began in the Exmouth Gulf of Western Australia. In 1963 bauxite

mining commenced in the Darling Ranges. In 1969 nickel mining began at Mount Windarra (Australian mining history, 2012; Department of Mines and Petroleum, 2012b). In 2012 Western Australia has 90,856 people working in 513 commercial mineral projects, 893 operating mine sites, 64 operating oil and gas fields and has 140 exploration managers helping to identify new mining opportunities in Western Australia (Resources Industry Training Council, 2010; Department of Mines and Petroleum, 2012b). In the 2011 calendar year the Western Australian mining industry was worth \$107 billion (Department of Mines and Petroleum, 2012a).

Major products mined in Western Australia include: Iron Ore, Gold, Alumina, Lead, Silver, Copper, Vanadium, Coal, Oil and gas, Nickel, Minerals Sands, Clays, Salt, Diamonds, Cobalt, Chromite, Manganese, Talc, Gypsum, Pegmatite, Limestone, Manganese, Molybdenum, Tin, Rare earths, Phosphate, Tantalum, Lithium, Uranium, Zinc, Silica - silica sand (Resources Industry Training Council, 2010).

In 1902 the Western Australian School of Mines (WASM) was founded in Kalgoorlie as a tertiary education school to provide work related education for people who planned to work in the Mining industry. Until 1969 this mining educational facility was managed by the Western Australian Department of Mines. In 1969 management of this School was transferred to the Western Australian Institute of Technology which in 1987 became Curtin University. The current Director of the Western Australian School of Mines is Professor Steve Hall. The current Director of the Western Australian Mines Safety Branch and State Mining Engineer with Resources Safety (the mining government regulatory authority), Simon Ridge, is a graduate of the Western Australian School of Mines. Both of these men, who are leaders in the Western Australian mining industry in 2012, have a strong focus on improving, and in maintaining improvements, in mining and mineral exploration health and safety practices.

Results

Health and safety in the Western Australian mining industry

In the 1800s and 1900s in Western Australia miners were at first individual prospectors who were responsible for their own safety and health. Individual mining was gradually replaced with company mining as a more profitable way of conducting mining. Below are the fatality statistics

for the Western Australian mining industry for the early 1990s.

Tab. 1 Western Australian mining industry fatalities 1901 - 1918 (Gilroy, 2012).

Year	Fatalities	Workforce	Incident rate per 1,000 workers
1901	45	16,755	2.68
1902	39	17,525	2.22
1903	42	17,329	2.46
1918	23	17,790	2.95

Over the years workplace health and safety has improved in the Western Australian mining industry as is demonstrated in the following graph.

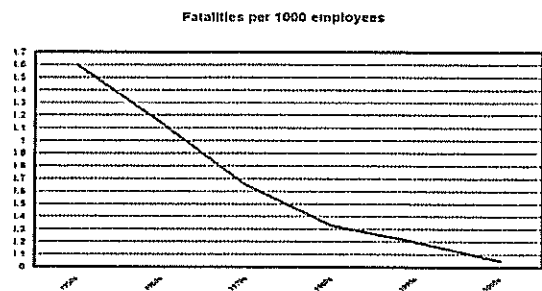


Fig. 1 Western Australian mining industry fatalities per 1,000 employees from the 1950s to the 2000s (Gilroy, 2012).

This improvement in workplace health and safety for miners in Western Australia was brought about by the combination of many factors that included improved mining industry health and safety laws, enforcement of these laws and the formation of the Mining and Resource Contractors Training Association which provides generic health and safety induction education for people before they work in the mining industry and refresher health and safety training for ongoing and updating work related health and safety education for mine workers.

In 1981 the value of mineral production in Western Australia was B\$2.692 produced in the main by five sectors (Department of Mines, 1981).

Tab. 2 Mineral production in Western Australia in 1981

	\$m's	Employees
Bauxite/Alumina	548	3378
Iron Ore	1,129	11,847
Nickel	324	3,141
Gold	153	2,147
Coal	68	962

Employment in the mining sector was 24,063 miners with 21,620 employed on the surface and 2,443 underground (Department of Mines, 1981). By 1988/89 the value of production had increased to B\$7.90 which included petroleum products valued at M\$69.6.

Tab. 3 Mineral production in Western Australia in 1988/9

	\$m's	Employees
Bauxite/Alumina	1.62	5,393
Iron Ore	1.78	8,849
Nickel	.63	3,271
Gold	2.03	9,915
Coal	.16	1,271
Diamonds	.36	824

In 1988/89 employment in the mining sector was 30,332 miners with 27,558 employed on the surface and 2,774 underground. The remarkable increase in gold production, occasioned by an escalating increase in value, saw the emergence of contracting organisations usually established by senior employees of corporations who grasped the opportunity to improve their immediate and future prospects. In 2012 in Western Australia 70% of the mining work force are employed by contractor companies.

In 1999 the incumbent Labor Government gave notice of its intention to introduce Robens -type occupational health and safety legislation for the Western Australian mining industry which would require employers to co-operate and consult with employees in the implementation of health and safety policies and procedures in the workplace. Employer response to the Government's proposals was initially negative as it was concerned at the potential for increased industrial activity by unions resulting from the appointment and empowerment of health and safety representatives.

The Occupational Health and Safety Act was proclaimed in Western Australia 1984 and, although the mining sector continued to operate under the Mines Regulation Act, there was a clear intention by Government to ultimately bring mining under the general industry legislation. An alternative was to amend the Mines Regulation Act to reflect the occupational health and safety principles applying to all other industries. In anticipation of this inevitability the mining industry began to introduce some of the principles of the Robens-type legislation into its procedures and practices and also began to work more closely with its regulatory authority in the drafting of legislation that reflected the Occupational Health and Safety Act 1984 of

Western Australia, and the considerable number of regulations necessary to reflect the legislative intent.

In 1989/90 the safety performance of the industry was acknowledged as unacceptable with a serious injury rate of 19 per 1,000 employees and a minor injuries rate of 48 per 1,000 employees. Fatalities at that time had risen to an alarming level of almost 20 per annum, occurring mainly in metalliferous underground mines. Contractors who were carrying out much of the work were coming under close regulatory attention at this time and were frequently accused of operating with inadequate safety practices and procedures.

The controversy regarding the introduction of health and safety representatives and the empowerment of the workforce following the proclamation of the Occupational Health and Safety Act in 1984 was a significant factor in generating a positive change of attitude in the mining sector. Today in the Western Australian mining industry there are 1,920 Safety and Health Representatives (Ho, 2012). These Health and Safety Representative have had a major influence in allowing employees to be involved in improving the workplace, work process and people's actions in relation to work related health and safety.

Aware of the commitment of the Government to incorporate Robens-type principles into the mining legislation, the Chamber of Mines established an Occupational Health and Safety Committee which met for the first time on 1 August 1983. The purpose of the meeting was to consider the likely effects of introducing the occupational health and safety into the industry. In the years that followed the composition of the Committee was augmented to include specific expertise from all major sectors and the direction of the Committee took a positive direction that spread quickly through the regional network of similar industry committees. Expertise in the augmented central committee included audiometry, industrial hygiene, occupational medicine and safety, and the Committee quickly became influential in negotiating with Government and, in particular, with its regulatory authority.

The Chamber's Annual Report for 1987 (The Chamber of Mines of Western Australia, 1987) commented that through its representation on the Western Australian Occupational Health, Safety and Welfare Commission, the Committee continued to provide positive input into decision making on health and safety in the workplace, the positive association with the Department of Mines in the preparation of appropriate amendments to the Mines Regulation Act and Regulations and its considerable input to the development of the new computerised Accident

Reporting System (AXTAT) for the mining industry, expected to take effect from 1 January 1987.

A major initiative in 1990 was the organisation of the first Minesafe International conference which was attended by representatives of 15 nations and established the Western Australian mining sector as a world leader in the discipline of occupational health and safety. Further conferences were held in Perth in 1993 and in 1996, in South Africa in 1998 and again in Perth in 2000. Papers presented at those conferences addressed every aspect of occupational health and safety in the mining industry.

Throughout the late 1980's and the 1990's a unique working relationship developed between industry and its regulatory authority, the Department of Minerals and Energy. The appointment in 1984 by Government of an experienced, highly competent mining engineer from industry to the position of State Mining Engineer, at a time of industry expansion and the introduction of occupational health and safety legislation changed the nature of the previous relationship from arms-length to close co-operation in the regulation of the health and safety industry.

A joint approach to the introduction of Robens-type principles to improve standards of occupational health and safety, which included the involvement of the contracting sector, began to impact on industry safety performance. The supportive response to the concerns of contractors led to the establishment of the contractor safety training organisation called the Mining and Resource Contractors Safety Training Association (MARCSTA) which was to play a significant role in the delivery of high quality safety inductions to most sectors of industry.

This not-for-profit organisation, formed in 1994 and incorporated in 1996, consisted of 19 operating companies whose primary objective was to replace repetitive and other questionable induction programs which were not providing an appropriate standard of induction training and were resulting in a negative response to occupational health and safety per se and incurring significant cost consequences. The formation of MARCSTA was given strong and enthusiastic support by the State Mining Engineer and his staff and was endorsed by the industry body.

This professional organisation is strongly involved in supporting occupational health and safety employee and workplace health and safety tertiary education for the mining industry. Since 2007 MARCSTA has provided the Jim Torlach Scholarship in memory of Jim Torlach who made an outstanding contribution to the improvement of safety and health in the Western Australian mining industry through his complete overhaul and modernisation of the mining legislation when he

was the State Mining Engineer. The Jim Torlach Scholarship pays the 3 years' study fees for one new student each year who enrolls to complete the Bachelor of Science (Health, Safety & Environment) at Curtin University. Graduates who have won this Scholarship have gone on to work in the Western Australian mining industry and have won awards for the excellence of their work in health and safety.

MARCSTA members also support mining industry health and safety research. For example Barmingo is funding research on the effects of exposure to diesel particulates on employees in an underground mine in Western Australia to identify ways to make working in underground mines safer. It is also supporting research to identify if cigarette smoking is a risk factor for noise induced hearing loss in Western Australian mining industry workers. There is strong industry involvement in the tertiary education of mining industry health and safety professionals. For example, to promote a high standard of mining industry safety and health management knowledge and skills Barmingo provide an annual \$5,000 prize for the student with the highest standard of health and safety management practice in the Bachelor of Science (Health, Safety and Environment) at Curtin University.

From the year 1989/90 the occupational safety and health performance of the industry began to reflect the combined efforts of industry, its contractors and the regulatory authority and the industry began gradually to move toward its target of world leadership in occupational safety and health. By 1998 the membership of the Chamber of Mines included no less than 17 major contractors, many of whom were represented on the various occupational health and safety committees of the Chamber, particularly in the Eastern Goldfields region. Contractors by this time were becoming increasingly active in all sectors of the industry and were demonstrating their commitment to achieving high standards of health and safety to meet industry's expectations.

The incidence of fatalities (number per 1,000 employees) declined from 0.527 in 1988/89 to 0.047 in 2010/11.

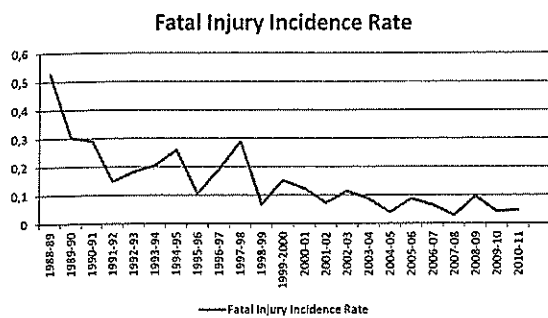


Fig. 2 Fatality Incident Rate per 1,000 employees in the Western Australian mining

The incidence of lost time and serious injuries was reduced similarly.

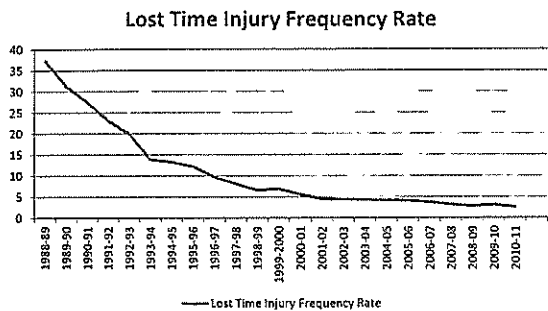


Fig. 3 Lost time injury frequency rate per million hours worked in the Western Australian mining industry

In 2012 contractors now provide the majority of production for the Western Australian mining industry and these employers are respected for the high standards of health and safety practices of their workforces.

Workers' compensation premiums are perhaps the most objective indicator of the health and safety standards existing in major industry sectors. The continual downward trend in premiums for the mining sector, particularly from 1990 onward, provide convincing and irrefutable evidence of the industry's status as a world leader in workplace safety and health. The contracting industry can rightly claim to have been a major influence in achieving this status and perhaps the most noteworthy aspect is the total absence of any conflict with major mining companies over the past 25 years in the transition occasioned by the introduction of the Robens style occupational safety and health legislation in Western Australia.

The Western Australian Department of Commerce (2012) has released data on occupational safety and health in Western Australia derived from workers' compensation claims in 2010/11 for

workers covered by the Workers' Compensation and Injury Management Act 1981 of Western Australia.

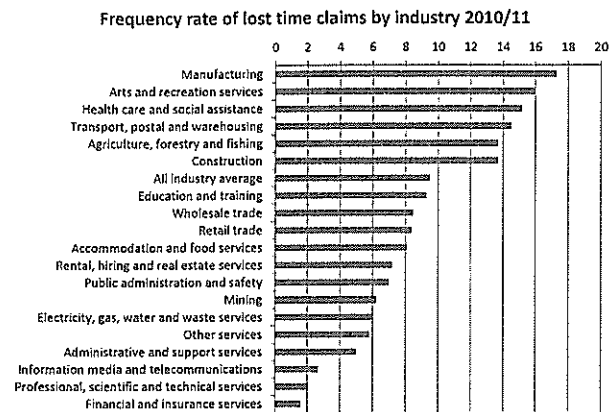


Fig. 4 Workers compensation lost time injuries per million hours worked in Western Australia

It is clear from this information that the mining industry in Western Australia is performing at a level unmatched in the world today.

Conclusion

Health and safety practices in the Western Australian mining industry have changed over time. In the days when only the Aboriginal people were Australian miners there was education provided by tribal Elders to develop the skills of the new miners to assist them to be able to work safely and effectively in the profession chosen for them. When the people of European decent commenced mining in Western Australia many of their mining practices were unsafe as they were not provided with education on how to work safely as miners. Particularly silicosis became a major occupational disease for the miners in the Western Australian Goldfields. Having good occupational health has become important in the Western Australian mining industry. With improved mine ventilation and work practices there have been no new cases of silicosis in the Western Australian mining industry for at least 20 years. There was also a high work related fatality rate in the Western Australian mining industry.

With the building of the Western Australian School of Mines in Western Australia formal education for mining industry employees began. Health and safety practices in the Western Australian mining industry were improved through the implementation of the Robens style mining health and safety legislation, enforcement of this education, the work that Pat Gilroy and others have done through the Chamber of Mines, the international mining conferences that were held in Western Australia, the

MARCSTA generic health and safety educational program available for everyone who works in the Western Australian mining industry, and through

the professionalization of mining industry workers' education and work practices.

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