MONITORING AND MANAGEMENT OF FITNESS FOR DUTY - A MINE SITE PERSPECTIVE

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Abstract:
This paper briefly examines chapter 7: Fitness For Duty sections of the new Mining Regulations discussion paper and what it means at the mine site. A question is posed regarding section 40 that deals with drugs. It gives an overview of the implementation of the Fit 2000 System at the Burton Opencut Coal Mine and its advantages and disadvantages. The paper will also discuss the outcomes of a fatigue research study conducted at the mine and the comparison of findings from the research with the data collected from the Fit 2000 system.

Introduction

Management and monitoring of an employee's fitness for duty is becoming more and more of an everyday occurrence within industry. The new mining regulation discussion paper clearly stipulates the responsibility of a mine to monitor and manage an employee's Fitness for Duty.

There are a number of systems available in industry today that measure alcohol, drugs, stress and fatigue in the workplace. Finding the right system or, a combination of a number of systems is the daunting task that companies face today. No matter what system is implemented, there is a significant cost attached in both time and money. For a system to work effectively it must be implemented as a joint partnership of management , employees and subcontractors.

Mining Legislation

Current Legislation

Fitness for Duty, under current legislation, identified mainly with alcohol and drug related occurrences. For a number of years, the industry has monitoring for alcohol use and this appears to have influenced the drinking habits of a majority of personnel working within the mining industry. Mines who have introduced random breath testing have seen a marked decrease in the number of employees coming to work with a blood alcohol content above the prescribed limit for that mine.

Current legislation is a bit vague when it come to drugs. It makes mention of intoxicating substances and the fact that an employee must inform their supervisor that they are on medication that may cause drowsiness. It does not mention anything about illegal drugs. So the implementation of random drug testing has, for a number of companies, been difficult to implement. This is understandable.

Current legislation does not equip the coalface with guidelines to address what some people refer to as a civil liberty area and that is freedom of choice and discrimination. When we are entering the era of the possible legalisation of Marijuana and setting up of shooting galleries, what right has a mine and

its employees to stop an individual from using recreational drugs. Civil liberty is not the reason for mines introducing random testing or management programs. It is there because the majority of workers in the industry want to go home safely at the end of their shift. We have an obligation to our work mates to ensure our actions do not endanger them and, they do not become a statistic.

New Legislation

The new legislation covering Fitness for Duty is found under Chapter seven of the Mining Regulations soon to be introduced to the industry. The new legislation covers four main areas of fitness for duty:

- Alcohol;
- Drugs;
- Fatigue;
- Physical or Psychological Impairment.

Alcohol is covered under sections 37 to 39 where it advises in 37, on the non consumption of alcohol on site, 38, not performing work or any activity on a mine site while under the influence and 39, where it sets out a guideline for a standard operating procedure for alcohol.

Section 39 states the following:

> A mine must have a standard operating procedure to set standards for the mine through which persons recognise the health and safety risk associated with the excessive consumption of alcohol.
>
> The standard operating procedure must provide for at least:
>
> (1) Education of the workforce;
> (2) An employee assistance program;
> (3) Provision for voluntary testing;
> (4) Random testing prior to persons starting work; and
> (5) Provision for testing on suspicion of impairment.

These guidelines set out a decisive path that workers at the coalface must take to implement a procedure to effectively manage alcohol on a mine site.

Drugs are sited under section 40 and it states the following:

> A mine must have a standard operating procedure to set standards for the mine through which persons recognise the health and safety risk associated with the improper use of drugs.
>
> The standard operating procedure must provide for at least:
>
> (1) Education of the workforce
> (2) An employee assistance program; and
> (3) Mine workers to notify and record at the mine site, the use of any medication that could impair their ability to perform tasks.

Why is there no mention of random testing prior to commencing work? This is becoming more acceptable within the industry today. There is no mention of provision for testing on suspicion of impairment.

Fatigue is covered under section 41 which states:

> A mine must have a standard operating procedure to set standards for the mine through which persons recognise the health and safety risks associated with fatigue.

There are no guidelines to follow under current or new legislation in the management of fatigue. Why? - because fatigue may take in all the characteristics of an individual. Each individual is different and is affected by fatigue in different ways.

This can also be said for section 42 which sets out the standard operating procedure for physical or psychological impairment.

A mine must have a standard operating procedure to set standards for the mine through which persons recognise the health and safety risks associated with a mineworker's physical or psychological impairment.

Explanatory Note
A person's fitness for duty may be impaired physically or psychologically through fatigue, stress, illness, alcohol, or drugs.

The new legislation in Fitness for Duty is a mixed bag. In some areas there are improved guidelines, while in other areas the guidelines have not gone far enough. These guidelines are basically awaiting companies and workers at the coal face to come up with solutions of effective management.

What does the new legislation mean to a mine site? It means that everyone on a site must understand and come to terms with the following words, their meaning and, how to monitor and manage their effects on personnel working at a mine whether they are management, employee or subcontractor.

Alcohol: -	Colourless volatile inflammable liquid forming the intoxicant element in wine beer and spirits
Drug: -	Substance used in medicine or as a stimulant or narcotic
Impairment: -	Damage, weaken
Fatigue: -	Extreme tiredness – caused by stress to muscle, organs, etc.
Stress: -	Demand on physical or mental energy
Physical: -	Of the body
Psychological: -	Of the mind, mental characteristic

(The Australian Concise Oxford Dictionary)

It was stated earlier that people had a duty of care to effectively manage Fitness for Duty on a mine site, and it is the responsibility of all personnel working on the site. This includes employees, management, subcontract employees and, subcontracting companies themselves.

Subcontract labour work is carried out on all sites and, in some case, makes up 30% of the personnel on site. While it is the responsibility of the operator on site to manage those workers while they are on site, it is the responsibility of their employer to be accountable for the Fitness for Duty of those employees sent to site to work.

To achieve this accountability, Thiess Pty Ltd, Burton Coal Operations have sent a letter to all subcontracting companies asking them to demonstrate how they intend to monitor and manage the new legislation with regards to Fitness for Duty.

How do we manage Fitness for Duty? Everyone experiences daily changes in his or her alertness, decision making abilities and motor skills. These changes may occur as a result of inadequate sleep, illness, use of medications, alcohol, drugs or a combination of these factors. Such changes can put an employee at high risk of causing errors and having an accident.

There is no one method for accomplishing this task. We know that stress, fatigue, physical impairment, psychological impairment, drugs and, alcohol affect each individual differently. So, there will be numerous methods and monitoring procedures along with research, required across the industry to gauge what is effective and what is not. This will cost the industry in both time and resources. One must ask the question, will this cost be offset by productivity gains, less accident costs and, most importantly, improved health and safety of the individual mine worker?

Implementation of Fit 2000 System

There are a number of programs and systems available to industry to monitor and manage different sections of the Fitness for Duty requirements. There is not however, one system or method that can do all. The Burton Coal Project has evaluated a number of systems and monitoring methods over the past three years and introduced alcohol and drug testing to the site during this period as a starting point. The project was still looking for a method of measuring a person's fitness for duty that was not as invasive as random alcohol and drug testing. During the later half of 1999 a Fatigue committee was formed to investigate other methods of monitoring fitness for work that would also take into account the requirements of the new legislation.

In November of 1999 the Fit 2000 system was set up on site for a trial period to gauge its effectiveness in monitoring a persons fitness for duty at the start of the shift.

What is the Fit 2000 system and how does it work?

The Fit 2000 system comprises of one or a number of screener units that take the readings of involuntary eye reflexes. These screener units are connected to a computer program by a variety of connective options. These include printed test results from the screener, connection from remote areas by email or server system to computer in different departments, the list and forms of connections are endless. The computer program itself is Access based and user friendly.

The Fit 2000 system uses a simple thirty second automated test of eye reflexes to identify those workers who are at high risk. Designed to be operated by the worker, the Fit 2000 is highly sensitive to changes in eye reflexes associated with factors known to cause impairments relevant to the workplace. While the Fit 2000 is sensitive to illegal drugs, it is not a drug test. The Fit 2000 identifies at-risk workers for a broad range of impairments.

Each employee establishes his/her baseline by completing a prescribed number of readings. Once a baseline has been established, the employee will then be given a reading of high or low risk with every subsequent reading based on that data being inside one standard deviation of their baseline for low risk or, outside one standard deviation for high risk.

The system has been installed at the Burton Coal Project for some eight months and during this time there have been a number of issues that have eventuated. Administering the Fit 2000 system in its initial implementation is labour intensive. This includes learning the system and understanding the meanings of the high risk, base unstable and other reports that are generated. Then ascertaining with the employee why the high risk/base unstable has occurred. A number of maintenance issues have to be completed each week with the data base to keep it functioning smoothly. Once the system is installed and the system administrator understands it, it then becomes a daily task of 15 to 30 minutes to maintain the system. The system is not one to be put on a site and forgotten. Companies that install this system will find that, when administered correctly, it is a good initial indicator of an individuals fitness for duty.

The system can not be used as the "be all to end all" for determining fitness for duty. If a worker gives a high risk reading at the start of the shift, this triggers a process of elimination to find out why the high risk has occurred. This will include alcohol and drug testing to eliminate these two factors. Then a process of one on one questioning with the employee will take place to identify the problem area. The cause of the high risk could be one of a number of events that have occurred. Some that have presented themselves include;

- lack of sleep;
- distance travelled to get to work
- time of morning the test is taken (the person is still asleep);
- change in light when walking into screener room;
- medication;
- stress caused through problems at home;
- sickness not work related;
- anxiety caused through peer pressure at work.

The Fit 2000 system appears to have changed the habits of some employees. It has increased the awareness of what constitutes fatigue and how, with minor changes to lifestyles workers can commence work in a fit state. Used as an indicator, the Fit 2000 system has a place along side other methods and systems used to monitor and manage fitness for duty.

Shiftwork Project

The following details a project investigating fatigue and shiftwork at Burton Mine. The project proposed to determine alertness levels during work periods, sleep quality and quantity during work and home periods, and how these related to factors affecting fatigue including job activity, alcohol, exercise, caffeine, medication and environmental factors.

The data was gathered in three stages:

1. A questionnaire on general lifestyle information related to work and home;
2. Sleep and alertness logs to gather information on sleep quantity and quality during home and work periods, and alertness levels during shifts;
3. FIT2000 measurements at the start of shift.

It is important to note that the results presented are based on the aggregated data and individuals may differ significantly from these results.

Burton mine is situated 40km south of the mining township of Glenden.

The majority of workers are rostered on the 4 day on - 4 day off schedule and are mainly production, maintenance, catering and other contract staff. These personnel work 12 hour shifts starting at 6am or 6pm. The 4 days on - 4 days off workers are divided into four crews - A, B, C, D and these crews were the main focus of the project.

95% of all workers at Burton stay on-site in mine supplied accommodation during work periods and drive home to Mackay, Glenden and other coastal towns for days off.

1. Health and Lifestyle Questionnaire

The health and lifestyle questionnaire covered the following areas:

- Demographic and background information;
- Food and drink, including alcohol usage;
- Activity and exercise;
- Smoking status;
- Drug usage including medication, sleeping pills, recreational or illegal drugs;
- Work environment.

145 members of the Burton workforce completed the questionnaire. This was a 40% response rate.

Analysis of the questionnaire indicated that while there were differences, there were no major factors in terms of diet, alcohol intake or exercise that should adversely affect fatigue levels on site when compared to home.

Workers generally had a satisfactory diet. Fewer workers drink on-site than at home and those who do drink tend to have a lower number of drinks. 11% of respondents drink on more than five days per week - in excess of the recommended NHMRC guidelines.

The responses to the exercise questions indicate that more workers exercise at home than at work. Those who exercise more than three times per week maintain this frequency during work periods.

The profile of smokers is consistent with the Queensland industry. Some respondents indicated that they had unsuccessfully tried to give up smoking. A “Quit Smoking” program may be of assistance to these workers.

The number of workers who acknowledged taking regular medication is very small. While individuals may need assistance and the effect of the medication needs to be taken into account in terms of alertness for these individuals, medication is not a significant issue in terms of shiftwork for the site.

Approximately 5% of respondents reported using sleeping pills when working night shift.

90% of respondents to the lifestyle questionnaire agreed that the workplace is a good place to receive information about health, lifestyle issues, shiftwork and stress management.

Approximately 10% of respondents reported experiencing problems balancing shiftwork, family and social life and work performance. This small portion could have significant effects on safety.

2. Sleep and Alertness Logs

The second part of the project required participants to complete a series of log books recording sleep and factors affecting sleep, and alertness during work shifts and factors that may affect alertness.

199 log books were completed.

(a) Sleep Log

The sleep log comprised three main sections:

Sleep ruler;
Sleep scale;
Sleep factors questions.

(i) Sleep Ruler

The sleep ruler is a twenty-four hour visual analogue scale on which the subjects were asked to indicate with an **"X"**, the time they went to sleep and with a **"√ "**,the time that they woke from the ***major sleep*** of the day.

(ii) Sleep Scale

Sleep quality was rated on a scale of 1 through 10:

1 equalled very restless sleep;
10 equalled sound sleep.

(iii) Sleep Factors

The sleep factors questions were selected and adapted from the National Sleep Foundation Sleep Diary (National Sleep Foundation, USA).

There were five major topics covered by the questions:

- consumption of caffeinated drinks;
- consumption of alcohol or a heavy meal prior to sleep;
- exercise;
- medications - types, dosages, time;
- other factors that disturbed your sleep.

Subjects were requested to fill out the three sections immediately upon waking from the major sleep of the day/night. Sleep logs were completed during both home and work periods. Table 1 shows the results of the sleep logs.

The comparison of sleep quantity indicates that the average sleep on night shift of 6.9 hours is 30 minutes less than the 7.4 hours on day work. The sleep during home periods of 8.2 hours is longer by 90 minutes than on night shift.

The quality of sleep is reported as the same during day shift or at home. The quality of sleep on night shift is decreased as expected. This decrease is slight and is also unlikely to contribute to a sleep debt. This small decrease in quality of sleep may reflect the standard of accommodation at Burton that allows sleep quality to be maintained when sleeping through the day.

It should be noted that individuals may have very different quantities and quality of sleep to the crew average, as indicated by the standard deviations. These individual differences will affect fatigue and alertness levels.

Table 1
Sleep Quantity and Quality during Day and Night Shifts and Home

Crew	Quantity (hours)						Quality					
	Day	Std Dev	Night	Std Dev	Home	Std Dev	Day	Std Dev	Night	Std Dev	Home	Std Dev
A	7.2	1.3	7.1	1.5	8.2	1.6	8.1	2.2	7.2	2.5	7.7	1.9
B	7.2	1.2	6.6	1.1	8.3	1.4	7.9	1.4	7.5	2.0	7.3	1.7
C	7.4	1.2	7.3	1.7	8.3	1.4	7.8	2.2	7.6	1.7	8.4	1.5
D	7.7	0.9	6.7	1.6	8.1	1.1	7.7	2.5	7.0	2.2	8.2	1.1
Average	7.4	-	6.9	-	8.2	-	7.9	-	7.3	-	7.9	-

Alcohol intake and exercise were not found to affect the quantity or quality of sleep reported.

Caffeine intake was found to have a negative effect on quantity and quality of sleep for crew A. Caffeine intake per person per day for crew A was not obviously different to other crews.

Based on the results of the logs, the use of medication was uncommon. Although it is unlikely to cause a problem at a site level, the effect on individuals needs consideration and management.

A small number of disturbances to sleep were reported and more disturbances were reported on night shift than on day shift or at home. The effect of these small number of disturbances was not reflected in the aggregate data.

(b) Alertness Logs

Average alertness levels over both day and night shift were positively correlated with quality of sleep before shifts, but not the length of sleep. Alertness levels fell over night shift more rapidly than during the day shift and the alertness level at the end of night shift was lower. There was considerable individual variation in the alertness levels reported. Examples of results are shown in Figures 1-3.

Figure 1

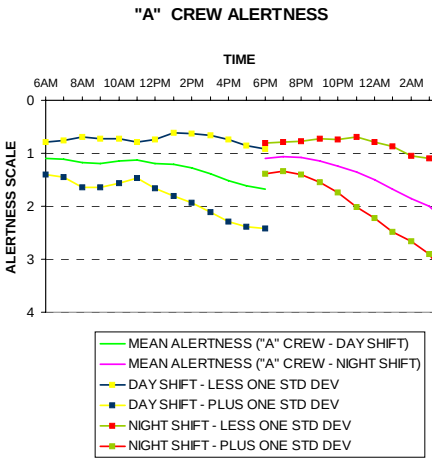


Figure 2

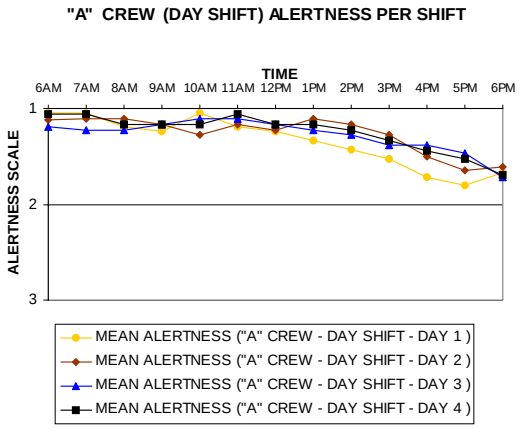
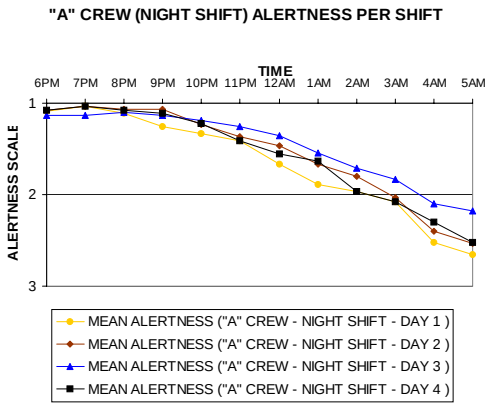


Figure 3



The current timing of breaks on night shift does not have an effect in improving alertness. The current timing of breaks is considered to be during the most appropriate period and some flexibility is encouraged. Overall results are shown in Figures 4 and 5.

Figure 4

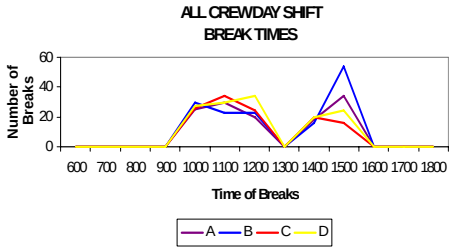
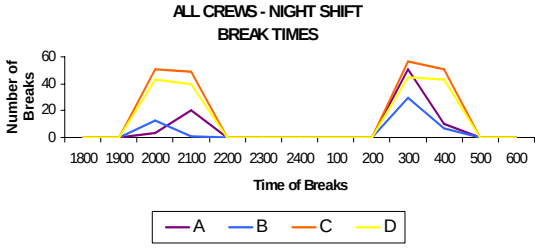


Figure 5



Workers were asked to rate the shift they completed. Table 2 indicates the aggregate rating given to shifts. 54% of responses indicated the day shift had been an easy shift. The ratings for night shift were evenly distributed and a higher percentage of the respondents found the shifts worked at night stressful when compared to the day shift rating.

The third night shift was found to be the most stressful - more stressful than number four night shift. The first day shift was found to be the most stressful.

Table 2
Rating of Shift

Shift	Easy		Physical		Stressful	
	No of responses	% of responses	No of responses	% of responses	No of responses	% of responses
Day	163	54	74	24	66	22
Night	70	32	71	32	81	36

3. FIT2000 Measurements

The available FIT2000 data, as supplied by Burton Mine, was analyzed to compare to the initial alertness levels recorded in the alertness logs. Of particular interest were the saccadic velocity and constriction latency which have been demonstrated in laboratory studies to be indicators of fatigue from sleep deprivation and extended wakefulness (Russo, 1999).

Average alertness levels recorded at the start of shift were positively correlated with saccadic velocity for day shift but not for night shift. Length of sleep was negatively correlated with constriction latency for night shift work but not for day shift.

The differences between controlled laboratory studies and field operations and some of the factors identified in the limitations of the study will have contributed to the results of the comparison.

The FIT2000 measurements taken at the start of the shift indicate if a worker is “fit for duty”. Alertness levels during and at the end of shift will be determined by rostering arrangement and factors during the shift.

Based on the aggregated data, the results of the project indicate that the current shiftwork patterns at Burton Mine are unlikely to cause fatigue or the accumulation of sleep debt to a level that is likely to increase accident or injury risk. The range of alertness levels and sleep quality and quantity reported indicates that individuals will be affected by shift arrangements to varying degrees and these individuals may experience a greater level of fatigue. Education and information programs on how to manage fatigue at an individual level should continue.

Summary

The title of this paper sums up the task that lies ahead for mine operators, their employees and, subcontractors in managing and monitoring Fitness for Duty. It cannot and will not be accomplished by a single party or, a single method. It will take team work, a lot of understanding and a lot of trials and research before the ideal combination of systems and procedures are reached for effective management.

As more and more people in the industry come to understand the meaning of the words that are associated with Fitness for Duty, the better they will become at managing it. This will only come about through training and education.

Legislation is advancing to assist us, but more research is required within the industry to have a better understanding of the effects of fatigue, physical and psychological impairment have on our workforce.

Based on the aggregated data, the results of the project indicate that the current shiftwork patterns at Burton Mine are unlikely to cause fatigue or the accumulation of sleep debt to a level that is likely to increase accident or injury risk.

It is important to recognise that factors affecting individuals and individual differences in lifestyle, fitness levels, diet and exercise and the ability to adjust to shiftwork still need to be taken into account.

The results of the project indicate that the management of shiftwork at a minesite level in terms of rostering, work arrangements and accommodation should be generally effective in controlling fatigue. Tasks requiring high levels of concentration or unfavourable environmental conditions should be scheduled during the times of higher alertness.

Use of fitness for duty testing such as the FIT2000 will allow the identification of impairment at the start of shift. The organisation of work and rostering arrangement will allow the level of alertness to be maintain during the shift. These organisational and rostering arrangement should be designed to prevent high levels of fatigue from developing during work periods.

The management of factors affecting fatigue of an individual is more complicated due to the limitations of control over many of these factors. Techniques for this management include the use of information and training materials on how lifestyle affects fatigue and information on the obligations of workers under the new Queensland Mining Act.

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