

MANDATORY CODE OF PRACTICE FOR RISK-BASED FATIGUE MANAGEMENT

VOH-COP-008

Version: 3.0

**This Code of Practice is Drawn Up in Accordance with The Guideline DMR
Reference Number 16/3/2/4-B2 Issued by the Chief Inspector of Mines**

Mine DMR Code : 0195

Reference : VOH-COP-008 Fatigue Management

Revision : 2

Effective Date : 30 November 2014

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: 22 October 2019

Next revision Date : 22 January 2025

**The Contents of this Document state the minimum requirements.
These requirements may be enhanced in the interest of Safety and Health.**

	Safety & Sustainable Development VENTILATION & OCCUPATIONAL HYGIENE	Doc #	VOH-COP-008
		Version #	3
		Implementation Date:	2015/04/24
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Author:	VOH Manager	Sanction:	General Manager
RISK-BASED FATIGUE MANAGEMENT			

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1. PURPOSE

To have in place a Code of Practice for Risk based Fatigue Management.

2. SCOPE

This Code of Practice applies to all Black Mountain Mining licenced areas

3. STATUS OF CODE OF PRACTICE

- 3.1 This COP was drawn up in accordance with Guideline Reference Number DME 16/3/2/4-B2 issued by the Chief Inspector of Mines
- 3.2 This is a mandatory COP in terms of section 9(2) and (3) of the MHSA
- 3.3 The COP may be used in an accident investigation/inquiry to ascertain compliance and also to establish whether the COP is effective and fit for purpose
- 3.4 The COP supersedes all previous relevant COP's
- 3.5 All managerial instructions, recommended procedures (voluntary COP's) and standards on the relevant topics must comply with the COP and must be reviewed to ensure compliance

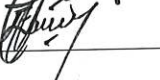
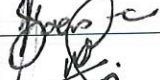
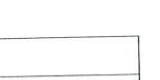
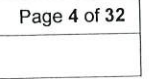
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4. MEMBERS OF THE DRAFTING / REVIEW COMMITTEE

4.1 In terms of section 9(4) of the MHSA, the Health and Safety Committee was consulted on the preparation, implementation or revision of this COP.

4.2 A committee was appointed for the review of this COP.

Members of the Drafting / Review Committee.

NAME	DESIGNATION	QUALIFICATION	AFFILIATION	EXPERIENCE	SIGNATURE
Charles Klopper	VOH Manager	Cert in Mine Environmental Control	Mine Ventilation Society (MVS)	25 years	
Eanthe Schrywer	Sect. OH Officer	BSc Hons	Mine Ventilation Society (MVS)	9 years	
Dr Andre Stoffels	Occupational Medical Practitioner	Diploma in Occupational Health	SASOM HPCSA	27 years	
Edwin Matlapeng	Safety Manager	B-Tech Safety Management	IOSM	30 years	
~~Nkosiyetu Masebeni~~	~~NUM Health & Safety~~	~~COMSOC 1 & 2 Blasting Certificate~~	~~NUM~~	~~21 years~~	~~~~
Llewellyn Barry	Full Time Health & Safety Rep	COMSOC 1 & 2		10 years	
Wendell Freeman	Full Time Health & Safety Rep	COMSOC 1 & 2 SAMTRAC		17 years	
Kotishi Mamosebo	Mining Manager	MMC	SANIRE	32 years	
~~ISMAEL MASHA~~ ~~Leon Roux~~	Section Manager: Mining	~~BTECH MIN, MD, MMCC~~		~~10 years~~	~~~~
Garth Boersma	HR Manager	P.G. Dip Management		28 years	
Marinus Hannekom	Plant Engineer	GCC, B.Eng, MBA	SAAMA	18 years	
Lance Williamson	Engineering Manager	GCC	AMRE	30 years	
Shane Links	Section Engineer	GCC Engineering		13 years	
Erich Katzke	Training Manager			29 years	
Adrian Landsberg	Manager: Process Plant	NHD		24 years	
Kobus Nel	Plant Production Manager			32 years	
Mbangani Mkheto	NUM Health & Safety	OPERATOR	NUM	16 Years	

Black Mountain Mining (Pty) Ltd

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Signed for on behalf of the Joint Health and Safety Committee:

L Barry

Name

[Signature]

Signature

04/02/2022

Date

W Freeman

Name

[Signature]

Signature

17/02/2022

Date

Approved – 4.1 Appointee:

X Qamata - General Manager

Signature:

[Signature]

Date:

22/03/2022

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5. GENERAL INFORMATION

5.1 MINE DESCRIPTION & LOCATION

Black Mountain is an underground Base Metal mine situated near the town of Aggeneys, 70 km west of Pofadder and 110 km east of Springbok, consisting of the following major areas:

- Deeps section (situated 8 km west of Aggeneys)
- Swartberg section (situated 15 km west of Aggeneys)
- Concentration Plant (situated 10 km west of Aggeneys)

5.2 COMMODITIES PRODUCED

The following main concentrates are produced at Black Mountain:

- Lead
- Zinc
- Copper

5.3 MINING METHODS

Black Mountain Mining is a mechanized mine utilizing the Cut & Fill and Blast-hole mining methods. The potential situations and/or sources that could give rise to fatigue are as follows:

5.3.1 WORK-RELATED CAUSES

The following work-related causes has been identified as potential contributing factors:

- Work time arrangements (work schedules, shift cycles)
- Call-out arrangements (which could vary depending on requirements)
- High physical (manual) workloads
- Occupational Environmental conditions
 - Airborne Pollutant exposures, including dust, gases and vapours
- Poor ergonomic design of workstations and equipment
- Work Stress

5.3.2 NON-WORK-RELATED CAUSES

The following non-work-related causes has been identified as potential contributing factors:

- Undiagnosed medical conditions
- Medications: prescription or "over-the-counter"
- Living conditions, including housing and nutrition
- Alcohol and substance abuse
- Lack of exercise / unhealthy lifestyles
- Excessive commuting

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5.4 UNIQUE FEATURES TO BLACK MOUNTAIN

The mine's remoteness:

- This has an influence on travelling times for employees staying in surrounding towns

Loop 10:

- A remote site approximately 150 km from Black Mountain. Travelling distances to/from the site has reference

5.5 OTHER RELEVANT COP'S, SOP'S, STANDARDS & PROCEDURES

The following documentation has relevance:

- COP 003: Noise
- COP 004: Thermal Stress
- COP 005: Minimum Standard of Fitness to Perform Work at a Mine
- COP 010: Airborne Pollutants
- SOP 003: Occupational Medical Surveillance
- SS 0003A and B: Job Placement Medical Guide Matrix
- Black Mountain Alcohol and Drug Abuse Policy
- VOH-BMF-008: Fatigue Risk Template

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6. TERMS & DEFINITIONS

As & When Required	This COP will be reviewed and updated after every serious incident relating to the topic covered in the COP or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material.
Bio-roster	A biologically compatible roster that takes into account the effects of circadian rhythms, sleep cycles and the additive effects of fatigue during the working week
BMM	Black Mountain Mining
Circadian Rhythm	The internal cycle of roughly 24 hours that regulates the physiological and behavioural activities of all living organisms – also referred to as “the body clock”
COP	Code of Practice.
DMR	Department of Mineral Resource
EAP	Employee Assistance Programme
Employee	Includes both BMM and Contractor & Business Partner employees
Fatigue	Reduced mental and physical functioning caused by sleep deprivation and/or being awake during normal sleep hours. This may result from extended work hours, insufficient opportunity to sleep, failure to use available sleep opportunities, or the effects of sleep disorders, medical conditions or pharmaceuticals which reduce sleep or increase sleepiness
FMC	Fatigue Management Committee
FMP	Fatigue Management Programme
MHSA	Mine Health & Safety Act, 1996 (Act No. 29 of 1996), as amended
MHSC	Mine Health & Safety Council
MQA	Mine Qualifications Authority
OMP	Occupational Medical Practitioner.
Risk	The likelihood that occupational injury or harm to persons will occur
SAQA	South African Qualifications Authority
SETA	A Sectoral Education and Training Authority established under the Skills Development Act No. 97 of 1998
Shift work	An organization of work where workers succeed each other at the same workplace while performing similar operations at different times of the day thus allowing longer hours operation than feasible for a single worker
Supervisor	Any individual having authority, in the interest of the employer and is responsible for the day-to-day performance of a group of employees
VOH	Ventilation & Occupational Health
Work schedule	The hours to be worked for each day, shift, week, month or year, as scheduled by the employer

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7. RISK MANAGEMENT

7.1 RISK ASSESSMENT

Section 11 of the MHSA requires the employer to identify hazards, assess the health and safety risks to which employees may be exposed while they are at work and to record the significant hazards identified and risk assessed. This COP, together with related documents, will address how the significant risks identified in the risk assessment process will be dealt with, having regard to the requirements of Section 11(2) and (3) that, as far as reasonable practicable, attempts are made to, in order of priority:

- Eliminate the risk at source
- Control the risk at source
- Minimize the risk
- Provide PPE insofar as the risk remains
- Monitor the risk via a formal programme

7.2 RELEVANT INFORMATION

In order to assist with the hazard identification and risk assessment process relevant information such as accident statistics, ergonomic studies, research reports, manufacturers specifications, approvals, design criteria and performance figure for all relevant equipment are being considered. This includes:

- Fatigue "What you need to know" (Anglo Base Metals, July 2009)
- Fatigue Risk Assessment (FRA) – Anglo Base Metals Piloted at Black Mountain Pty. Ltd (Fatigue Management Solutions Ltd, 2009)
- Fatigue Management Plan (NSW Mine Safety Advisory Council / Government, December 2009)
- Ergonomic risk evaluations
- Vibration risk audit and monitoring
- Occupational Environment survey information

The process also includes information being gathered on work and non-work-related causes of fatigue through the completion of questionnaires by employees covering all mining & engineering sections, the concentrator plant, general surface area and main workshops. The questionnaires include the following:

- VOH-BMF-008: Fatigue Risk Template

The risk assessment is conducted, systematically identifying the risk of all the processes and contributing factors and these risks is then prioritized. BMM Occupational Hygiene Baseline Risk Assessment is updated based on the information to have an integrated approach to health and hygiene risks. Please refer to the figure below for the Risk Assessment Process Flow.

7.3 PERIODIC REVIEW

In addition to the periodic review required by Section 11(4) of the MHSA, this COP will be reviewed and updated after every emergency, altered circumstance, or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material. The periodic review will not exceed a period of three (3) years.

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RIM SCHEDULE: 7D - 7O, 7N - 7O (12H) 0600 ST

Shift	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Week
Trk	OFF	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	1
RM	1	-1	1	2	2	1	0	RM
Trk	06:00-18:00	OFF	OFF	OFF	OFF	OFF	OFF	2
RM	2	2	4	5	3	10	10	RM
Trk	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	3
RM	7	-1	0	0	-1	2	3	RM
Trk	06:00-18:00	OFF	OFF	OFF	OFF	OFF	OFF	4
RM	4	-1	3	5	2	10	10	RM
Trk	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	5
RM	5	-1	1	2	2	1	0	RM
Trk	06:00-18:00	OFF	OFF	OFF	OFF	OFF	OFF	6
RM	6	2	4	5	3	10	10	RM
Trk	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	7
RM	7	-1	0	0	-1	2	3	RM
Trk	06:00-18:00	OFF	OFF	OFF	OFF	OFF	OFF	8
RM	8	-1	3	5	2	10	10	RM

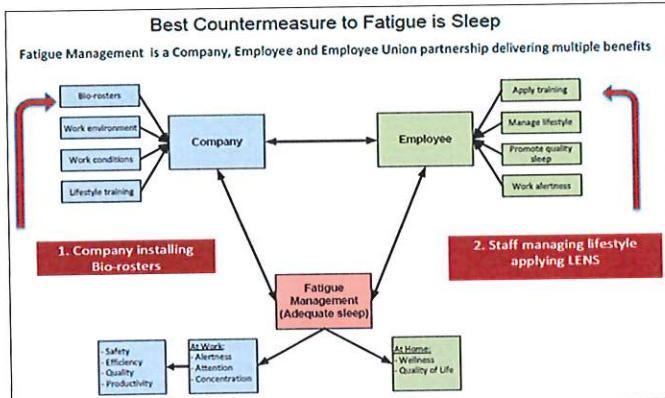
FULCO 24/7 12 Hr - 0600 Start Time

Risk Index Legend

10 to 5	Low	Green	20	36%
4 to 2	Guarded	Yellow	10	18%
1 to -1	Significant	Orange	20	36%
-4 to -2	High	Red	6	10%
-10 to -5	Severe	Purple	0	0%

46% in Significant - High Risk

AVG. RISK/DAY = 2.96



vedanta

FATIGUE MANAGEMENT QUESTIONNAIRE

- Department (e.g. Mining/Engineering/TSO/Services):
- Section (e.g. Trammings/Boiler making):
- Type of shift / Type of shift hours / How long is your shift?

5 day 8 hour	4 on / 4 off 12 hour	Other
--------------	----------------------	-------
- Gender / What is your age?

Male	Female
------	--------
- Hours sleep / How often do you sleep?

Less than 4.5	4.5 - 6	6 - 7.5	more than 7.5
---------------	---------	---------	---------------
- Sleep Environment / Sleep environment is good?

Quiet / No disturbance	Mildly Noisy	Moderately Noisy	Extremely noisy / disturbing
------------------------	--------------	------------------	------------------------------
- How long do you travel to work and back? How long does it take you to get to work in the morning?

To work (minutes)	To home (minutes)
-------------------	-------------------
- Fitness level - amount of exercise per day / How often do you exercise?

No exercise	less than 30min	30min - 60min	more than 60min
-------------	-----------------	---------------	-----------------
- Do you suffer from any chronic diseases? (e.g. high blood pressure, diabetes, etc.)

Yes	No
-----	----
- How many breaks do you take per shift? (including tea, coffee, etc.)

Break 1	Break 2	Break 3	Break 4
min	min	min	min
- How long do you work before you take a break? How long is the break? (e.g. 15 min, 30 min, etc.)

Break 1	Break 2	Break 3	Break 4
min	min	min	min
- How long are the breaks? (e.g. 15 min, 30 min, etc.)

Break 1	Break 2	Break 3	Break 4
min	min	min	min
- Lifestyle:

Never	1 - 2 Times a week	3 - 4 Times a week	more than 5 Times a week
-------	--------------------	--------------------	--------------------------
- How often do you go out socializing? (e.g. to a bar, club, etc.)

None	less than 2 drinks	2 - 4 drinks	more than 4 drinks
------	--------------------	--------------	--------------------
- How many drinks do you consume daily? (e.g. 1, 2, 3, 4, etc.)

Yes	No
-----	----
- Smoking / Do you smoke?

Yes	No
-----	----
- Did you have a meal before starting your shift? (e.g. yes, no, etc.)

Yes	No
-----	----
- Do you plan to have a meal during your shift? (e.g. yes, no, etc.)

Yes	No
-----	----
- How many years of experience do you have in your occupation? (e.g. 1, 2, 3, 4, etc.)

less than 1 Year	1 - 2 Years	2 - 3 Years	more than 5 Years
------------------	-------------	-------------	-------------------
- How many hours do you work overtime per month? (e.g. 1, 2, 3, 4, etc.)

less than 10 hours	10 - 15 hours	15 - 20 hours	more than 20 hours
--------------------	---------------	---------------	--------------------

RIM SCHEDULE: 4D - 4O, 4N - 4O (12H) 0600 ST									
Details	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Week	
Time	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	
RM	3	3	3	2	5	6	8	RM	
Time	OFF	18:00-06:00	18:00-06:00	18:00-06:00	18:00-06:00	18:00-06:00	18:00-06:00	18:00-06:00	2
RM	5	1	0	1	0	3	5	RM	
Time	OFF	OFF	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	3
RM	7	8	3	3	3	2	5	RM	
Time	OFF	OFF	OFF	18:00-06:00	18:00-06:00	18:00-06:00	18:00-06:00	18:00-06:00	4
RM	6	8	3	1	0	1	0	RM	
Time	OFF	OFF	OFF	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	06:00-18:00	5
RM	3	5	7	8	3	3	3	RM	
Time	06:00-18:00	OFF	OFF	OFF	OFF	18:00-06:00	18:00-06:00	18:00-06:00	6
RM	2	5	6	8	9	1	0	RM	
Time	18:00-06:00	18:00-06:00	OFF	OFF	OFF	OFF	06:00-18:00	06:00-18:00	7
RM	1	0	3	5	7	8	3	RM	
Time	06:00-18:00	06:00-18:00	06:00-18:00	OFF	OFF	OFF	OFF	OFF	8
RM	3	3	2	5	6	8	9	RM	

FULCO Gariep Khoi 24/7 12 Hr - 0600 Start Time														
Risk Index Legend														
10 to 5	Low	Green	25	44%										
4 to 2	Guarded	Yellow	19	34%										
1 to -1	Significant	Orange	12	22%										
-4 to -2	High	Red	0	0%										
-10 to -5	Severe	Purple	0	0%										
22% in Significant Risk														
AVG. RISK/DAY = 4.13														

Figure 1: Assessment of Shift Cycles

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8. ASPECTS ADDRESSED IN THE COP

8.1 FACTORS ADDRESSED IN THE CODE OF PRACTICE

8.1.1 CAUSES OF FATIGUE

Human fatigue is multifactorial and from a health and safety perspective, this COP will set a process for determining general considerations for fatigue management, including the assessment of both work related and non-work related factors. The risk assessment approach is primarily divided into two activity phases: Data collection phase and risk determination (calculation) phase as depicted in the Risk Assessment Process Flow.

8.1.1.1 WORK-RELATED CAUSES

The following work-related causes are considered during assessments and evaluations. For details on how the significant risks will be addressed please consult the Health Improvement Plan, relevant Procedures and/or Codes of Practice. Below is a brief overview:

- a) Work time arrangements (work schedules, shift cycles), including the following:
 - 4 x 12 hour on-shift / 4 off-shift cycles (also referred to as 4x4 shifts), rotating between day and night shifts cycles
 - The majority of mining and plant production employees as well as certain engineering employees are on a 4x4 shift cycle
 - 5 day work week with 8 hour shifts, day shift only
 - Although most employees in this category are not exposed to a significant risk, some could be due to the working of over-time and/or call-out due to breakdowns or emergency situations
 - Over-time & Call-out arrangements (which could vary depending on requirements)
 - Limited to 40 hours over-time in a month
- b) High physical (manual) workloads, with self-pacing and rest breaks a main means of control
 - Construction crews, including backfill and other civil construction works
 - Conveyor-belt cleaning crews
 - Back-lashing operations
 - TMM Maintenance crews
- c) Occupational Environmental stressors / conditions
 - Thermal Stress: heat & cold
 - Monitored and reported in accordance with the SAMHOP Codebook requirements
 - VOH Department: Temperatures measured in work areas during VOH surveys and reported to line management; corrective action as and when required
 - Line supervisors: Temperatures measured in underground workings as part of the "safe declaration" process
 - Most equipment fitted with enclosed cabins and air-conditioners to minimize exposures
 - Noise Exposures
 - Personal noise: Monitoring and reported in accordance with the SAMHOP Codebook requirements
 - Area noise: measured and reported in accordance with the MHSC Noise Milestones
 - Vibration
 - Monitored and reported to relevant stakeholders for information and corrective action as required
 - Airborne Pollutant exposures, including dust, gases and vapours
 - Monitoring and reported in accordance with the SAMHOP Codebook & MHSA requirements

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- Various means of control implemented, for example spray and extraction systems
- d) Poor ergonomic design of workstations and equipment
 - Ergonomic risk evaluations to determine equipment and workstations of poor design and contributing to fatigue
- e) Work Stress

8.1.1.2 NON-WORK-RELATED CAUSES

Non-work-related causes that can lead to fatigue are listed below. Due to the confidentiality required concerning medical conditions the Occupational Medical Practitioner will review and consider these during medical surveillance. However, medical condition information will be included in awareness and education material:

- a) Diagnosed and Undiagnosed medical conditions
 - Sleep disorders or restless leg syndrome
Most sleep disorders are treatable but if left untreated, including Obstructive Sleep Apnoea (OSA) can impair health, reduce alertness and impair performance. Higher than normal BMI is an OSA risk factor. Due to a number of lifestyle factors, from dieting habits and timing of eating (circadian cycle limits, metabolising of food during night hours) shift workers are at greater risk of exceeding normal BMI range than day workers. Untreated, OSA can lead to serious health problems including high blood pressure and heart disease and can be a risk factor for diabetes.
 - Chronic Fatigue Syndrome
- b) Medication
 - Certain medication can give rise to fatigue as it interrupts sleep patterns or cause drowsiness
 - Employees are required to inform the OMP and/or their line management if they are on medication that could have fatigue implications
 - Medication used by employees are reviewed by the Occupational Medical personnel during pre-employment and periodical medical examinations
- c) Living conditions: Housing & nutrition
 - Awareness and education campaigns to provide information, forming part of the Fatigue Management Programme
- d) Personal and family problems
 - Initiative such as Employee Assist Programme (EAP) exists to assist employees
- e) Alcohol and substance abuse
 - The BMM Alcohol and Drug Policy have reference
 - Alcohol tests are conducted at all major entrances to the mine on a continuous basis for all employees entering the mine
 - Drug tests are conducted as part of the medical surveillance programme as well as at ad hoc times
 - An Employee Assist Programme (EAP) exists to assist employees
- f) Lack of exercise
 - Healthy lifestyles are continually promoted through Toolbox Talks, Monthly Talk Topics as well as other mine wide communication

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- A possible consequence is that this can result in a BMI in excess of 30kg/m² (obesity) and can be a contributor to the risk of fatigue
 - BMM also has Health Awareness Campaigns which includes health and fitness of employees and family
- g) Excessive commuting:
- A number of employees reside in surrounding towns, including Pella (±60 km), Pofadder (±67 km) and Springbok and surrounding areas (±110 km to 130 km). This results in additional traveling time between home and BMM.
 - A number of employees make use of "lift clubs" meaning that fewer employees travel on their own over these distances
 - BMM also strongly recommends that employees ensure that persons in the lift clubs assist with keeping the driver of the vehicle awake during commuting

8.1.1.3 TOTAL WORKER FATIGUE

The fatigue experienced by individuals is usually a combination or accumulation of several factors – the "Fatigue Management Calculator" is utilized to calculate the Risk Index and Fatigue Index, from which the Black Mountain Risk Matrix is used to determine the risk ranking (calculation is based on the equation as depicted below):

$$F_T = F_{SS} + F_{EW} + F_{PF}$$

Where:

F_T = Total Fatigue

F_{SS} = Fatigue caused by shift system / work time arrangements

F_{EW} = Fatigue caused by poor ergonomics, environmental and work factors

F_{PF} = Fatigue caused by personal factors such as insufficient/poor sleep, health, nutrition and personal lifestyle

8.2 DEVELOPMENT OF THE BMM FATIGUE MANAGEMENT PLAN

The goal of the BMM Fatigue Management Plan is to continually improve and maintain health & safety in the workplace. An integrated process will be followed as various factors can contribute to fatigue and, as the Fatigue Management Programme becomes more mature, it will be incorporated into the BMM Health Improvement Plan. The Fatigue Management Plan will be utilized to document and monitor progress against the plan will be continually reviewed and updated.

The schematic below depicts the process BMM will follow for the developing and maintaining of a successful Fatigue Management Plan which consists of a number of interrelated elements:

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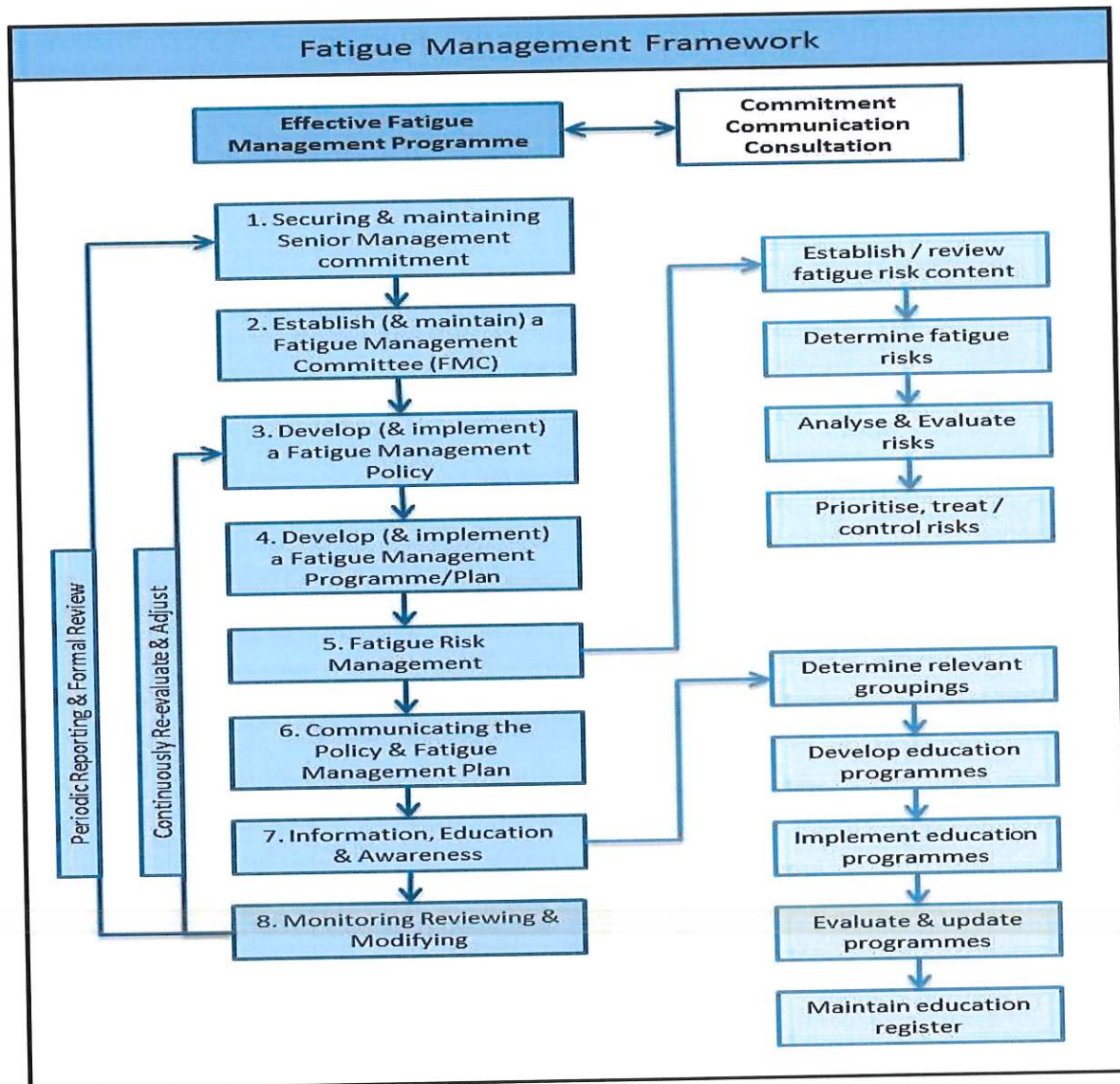


Figure 2: Fatigue Management Framework

8.2.1 MANAGEMENT COMMITMENT & STAKEHOLDER BUY-IN

In order for a Fatigue Management Programme (FMP) to be effective, senior management must commit the necessary support, endorsement and allocate sufficient resources to establish, sustain, monitor and optimise the plan.

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8.2.1.1 Responsibilities for the Fatigue Management Programme (FMP) Development

The overall responsibility resides with management, but this responsibility is delegated to the Fatigue Management Committee. The committee can include any relevant Resources, Stakeholders or Role players from time to time as required to implement and maintain a successful FMP. Responsibilities, authority, accountability and resources for managing fatigue will be defined within the FMP. These roles and responsibilities will include:

- Objectives to be achieved and benefits of the FMP for safety, performance and business
- Identifying internal and external resources, support and expertise required for the implementation, monitoring and continuous improvement of the FMP
- Developing procedures for the handling of employee fatigue cases
- Initializing protocols and objectives to evaluate the FMP and will include pre & post Key Performance Indicator (KPI) analysis and audit of compliance
- Planning, implementing and executing all facets of the FMP

8.2.2 FATIGUE MANAGEMENT COMMITTEE (FMC)

Due to the complexities involved in the design, implementation, monitoring and review of a Fatigue Management Plan a committee will be established to discuss and address the identified circumstances and the control measures required for effective Fatigue Management. This Fatigue Management Committee will form part of the BMM Health Improvement Plan Process to address fatigue from an integrated health & hygiene focus and could comprise of the following positions (note that these can vary depending on requirements), with the chairperson and scribe selected by the members of the committee:

No	Designation
1	VOH Manager
2	Occupational Medical Practitioner
3	Senior HR Official
4	Chief Safety Officer
5	Full Time Health & Safety Representative: Surface
6	Full Time Health & Safety Representative: Underground
7	NUM Health & Safety Representative
8	Plant Engineer / Production Representative
9	TMM GES
10	Section Manager: Mining
11	Senior Training Official
12	Supply Chain Representative
13	Ad Hoc (as & when required)

This committee will report through the Fatigue Management Champion (HSE Manager) to BMM Management (EXCO) and the Joint SHE Committee on the progress against the Fatigue Management Plan.

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8.2.3 FATIGUE MANAGEMENT POLICY

A Fatigue Management Policy has been drafted and approved - Refer to SSD-POL_009 Fatigue Management Policy

8.2.4 FATIGUE RISK MANAGEMENT

The fatigue risk assessment process is to identify fatigue hazards and its consequences on health, safety and performance:

- Identify the extent and nature of fatigue risk exposure; and
- Confirm the fatigue management capacity of existing controls, practices, policies and fatigue management program

The risks identified by the Fatigue Risk assessment will then be ranked in order of their potential impact on safety and performance, and appropriate control measures applied and implemented to address the most serious risks. The flowchart below depicts the risk assessment process:

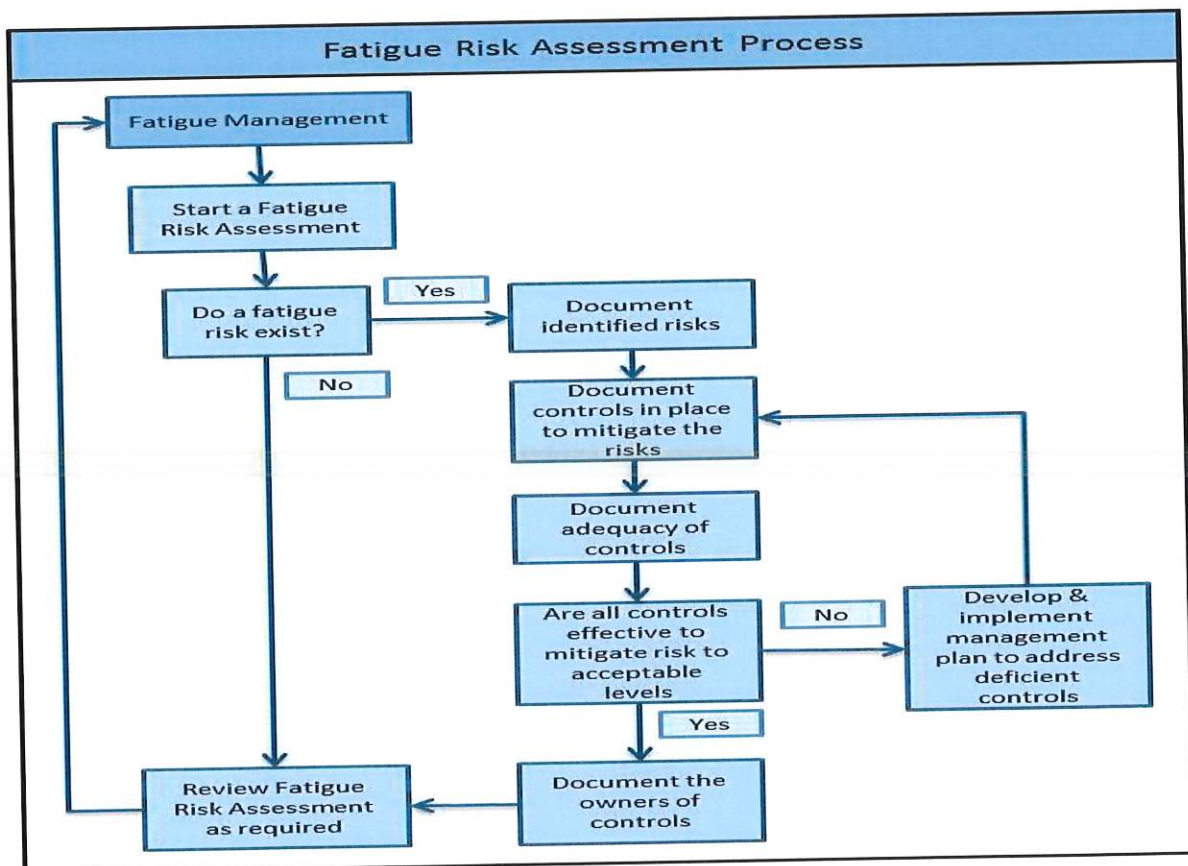


Figure 3: Fatigue Risk Assessment Process

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8.2.4.1 Hazard Identification: Step 1

a) Identify factors that contribute to fatigue

The identification and collection of data on potential factors contributing to fatigue is done through various mediums, including:

- Consultation with employees and the risk evaluation sheets completed by employees
- Examining of work rosters
- Consultation with workplace health & safety representatives and committees
- Health & safety audits
- Analysis of incident & injury reports (to form part of the investigation process)

b) Identify the hazards of fatigue

The data is collected by means of questionnaires, for example the Fatigue Management Template, completed by each employee who forms part of activities in a shift. The data relates to:

- Employee's duration of sleep
- Noise level in sleeping environment
- Duration time for commuting to work
- Employee's fitness levels
- Overtime worked
- Duration and frequency of fatigue breaks
- Lifestyle related information related to meals, alcohol consumption, smoking patterns, socializing patterns etc.
- Experience in years of operating a machine at work, etc.

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8.2.4.2 Risk Assessment: Step 2

In order to assess the risks associated with the factors that contribute to fatigue, the collected data from all individual employees is then grouped into statistical categories and transferred onto the relevant statistical category worksheet in the Fatigue Management Calculation tool. Averages for each applicable statistical category worksheet are automatically calculated via predetermined formulas and the risk ranking determined from the 5x5 risk matrix based on the average of the work team.

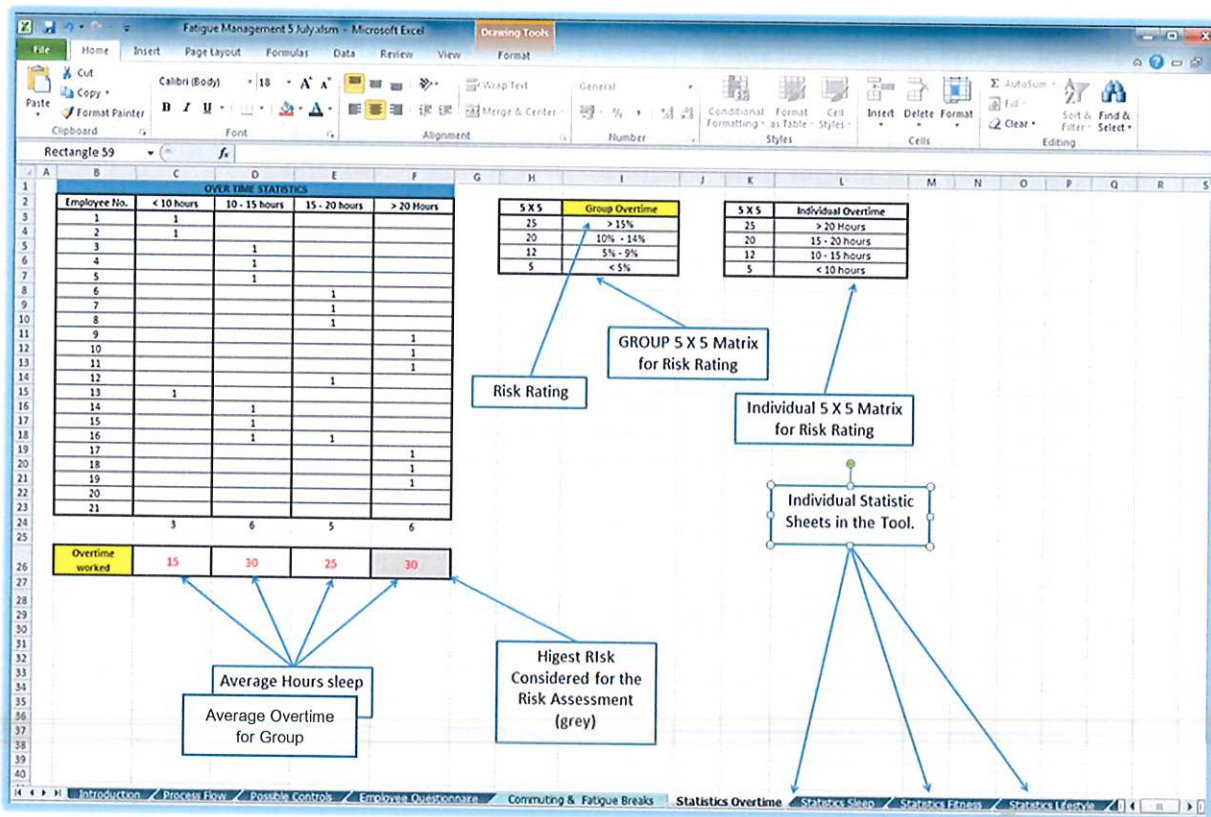


Figure 5: Work – Sheet showing Overtime Statistics (example)

The VOH Manager or representative together with Line Management will identify the Workload and Attention levels for each pre-determined activity.

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		FATIGUE MANAGEMENT: WORKLOAD & ATTENTION MATRIX																		
Typical Workload and Attention of the listed Activities Drawn up By: _____ Date: ____/____/20____ Name: _____ Signature: _____		WORKLOAD Typically is:	Extremely Monotonous Low Physical Demand	Moderately Monotonous High Physical Demand	Moderately Interesting Low Physical Demand	Extremely Interesting High Physical Demand	ATTENTION Typically requires Attention:	All or nearly All the time	Most of the Time	Some of the Time	Rarely or nearly none of the Time									
Listed Activities																				
1	Engineering												x					x		
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Figure 6: Type of job: Workload & Attention levels (example)

The VOH Officer will determine the risk ranking of the working environment (Noise, Airborne Pollutants, Vibration and Temperature) for each pre-determined activity. Ranking will be based on the Occupational Hygiene Risk Assessment.

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Environmental Conditions of the Drawn up By: Date: <u> </u> / <u> </u> / 20 <u> </u>		FATIGUE MANAGEMENT: ENVIRONMENTAL CONDITIONS MATRIX																			
Name:	Signature:	Noise	A-Category	B-Category	C-Category	D-Category	Airborne Pollutants	A-Category	B-Category	C-Category	D-Category	Thermal	A-Category	B-Category	C-Category	D-Category	Vibration	A-Category	B-Category	C-Category	D-Category
Listed Activities																					
1	Engineering			x						x					x						x
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					

Occupational Work Environment				
Noise	A category HEG = 25	B category HEG = 20	C category HEG = 12	D category HEG = 5
Airborne Pollutant	A category HEG = 25	B category HEG = 20	C category HEG = 12	D category HEG = 5
Thermal	A category HEG = 25	B category HEG = 20	C category HEG = 12	D category HEG = 5
Vibration	> 7.5 Hours a day = 25	>5 & <7.5 Hours a day = 20	>2.5 & <5 Hours a day = 12	<2.5 Hours a day = 5

Figure 7: Occupational Hygiene Risk Ranking for Fatigue Management (example)

8.2.4.2.1 Calculation of the Indices for Fatigue and for Risk

Complete all the input data as required in the applicable statistical category worksheet. Once done, update / complete the data in the "calculator worksheet and click the "Calculate Index" button – the Risk Index and Fatigue Index are then calculated. While the two indices are similar in many respects they diverge in others. The main differences are due to the different time of day effect:

- The peak in risk occurs close to midnight,
- Whereas the peak in fatigue tends to occur some five hours later, in the early morning.

Therefore, when assessing a pattern of work it is important to review both the Fatigue and Risk indices.

In the spread sheet, both the Fatigue and the Risk indices are expressed in terms of three individual components:

- A cumulative component. This relates to the way in which individual duty periods or shifts are put together to form a complete schedule. The cumulative component associated with a particular shift depends on the pattern of work immediately preceding that shift.

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- b) A component associated with duty timing, i.e. the effect of start time, shift length and the time of day throughout the shift.
- c) A job type / breaks component. This relates to the content of the shift, in terms of the activity being undertaken and the provision of breaks during the shift.

			Defaults	Reset Index	Calculate Index	Risk Index						Fatigue Index			
Day	On Duty	Off Duty	Job type / breaks	Commencing Time	Duty Length	Rest Length	Average duty per day	Cumulative component	Duty timing component	Job type / Breaks component	Risk Index	Cumulative component	Duty timing component	Job type / Breaks component	Fatigue Index
1	06:00	18:00	Individual	Individual	12h	Fully Rested	12h	0.89	1.04	0.99	0.91	0.1	1.1	1.1	2.3
2	06:00	18:00	Default	Default	12h	12h	12h	0.94	0.92	1.03	0.89	2.4	0.9	3.0	6.2
3	06:00	18:00	Default	Default	12h	12h	12h	0.98	0.92	1.03	0.94	6.2	0.9	3.0	9.9
4	06:00	18:00	Default	Default	12h	12h	12h	1.03	0.92	1.03	0.98	10.0	0.9	3.0	13.5
5	06:00	18:00	Default	Default	12h	12h	12h	1.08	0.92	1.03	1.02	13.1	0.9	3.0	16.5
8	06:00	18:00	Default	Default	12h	2d 12h	9h	0.91	0.92	1.03	0.87	1.8	0.9	3.0	5.6
9	06:00	18:00	Default	Default	12h	12h	9h 20m	0.96	0.92	1.03	0.91	5.4	0.9	3.0	9.1
10	06:00	18:00	Default	Default	12h	12h	9h 36m	1.01	0.92	1.03	0.96	9.3	0.9	3.0	12.9
11	06:00	18:00	Default	Default	12h	12h	9h 49m	1.05	0.92	1.03	1.00	12.5	0.9	3.0	15.9
12	06:00	18:00	Default	Default	12h	12h	10h	1.10	0.92	1.03	1.05	15.0	0.9	3.0	18.3
15	06:00	18:00	Default	Default	12h	2d 12h	8h 48m	0.92	0.92	1.03	0.87	2.1	0.9	3.0	5.9

Figure 8: Occupational Hygiene Risk Ranking for Fatigue Management (example)

8.2.4.2.2 Risk Ranking

The Fatigue and Risk Index Risk Rating will be populated automatically in the first two rows of the Risk Ranking table. The Identified hazards in each individual worksheet as was determined and risk ranked, must be listed on the Risk Ranking table (figure 9) as well as their respective rankings in the adjacent column (grey background). Risk Ranking values are the values as previously determined in the Statistical Category sheets derived from the employee questionnaires.

The average of all the listed rankings in the Risk Rank column will be calculated and automatically inserted at the bottom row of the Risk Ranking table (figure 9). This average number for the activity will then be categorized according to the Black Mountain 5x5 matrix table. This will be your average risk ranking for the specific activity.

Additional information and evidence of fatigue-related incidents will also be used to assist in the risk assessment process and will include:

- Incident reports
- Self-reports and complaints from employees
- Reports from supervisors about any evidence of fatigue
- Aggregate data from any Employee Assistance Programmes (EAP) - ensure that confidentiality is maintained when using such data
- Environmental and medical monitoring and other advice from those with technical expertise in the relevant disciplines. From this information, determine the risk factors that need to be controlled and prioritise actions.

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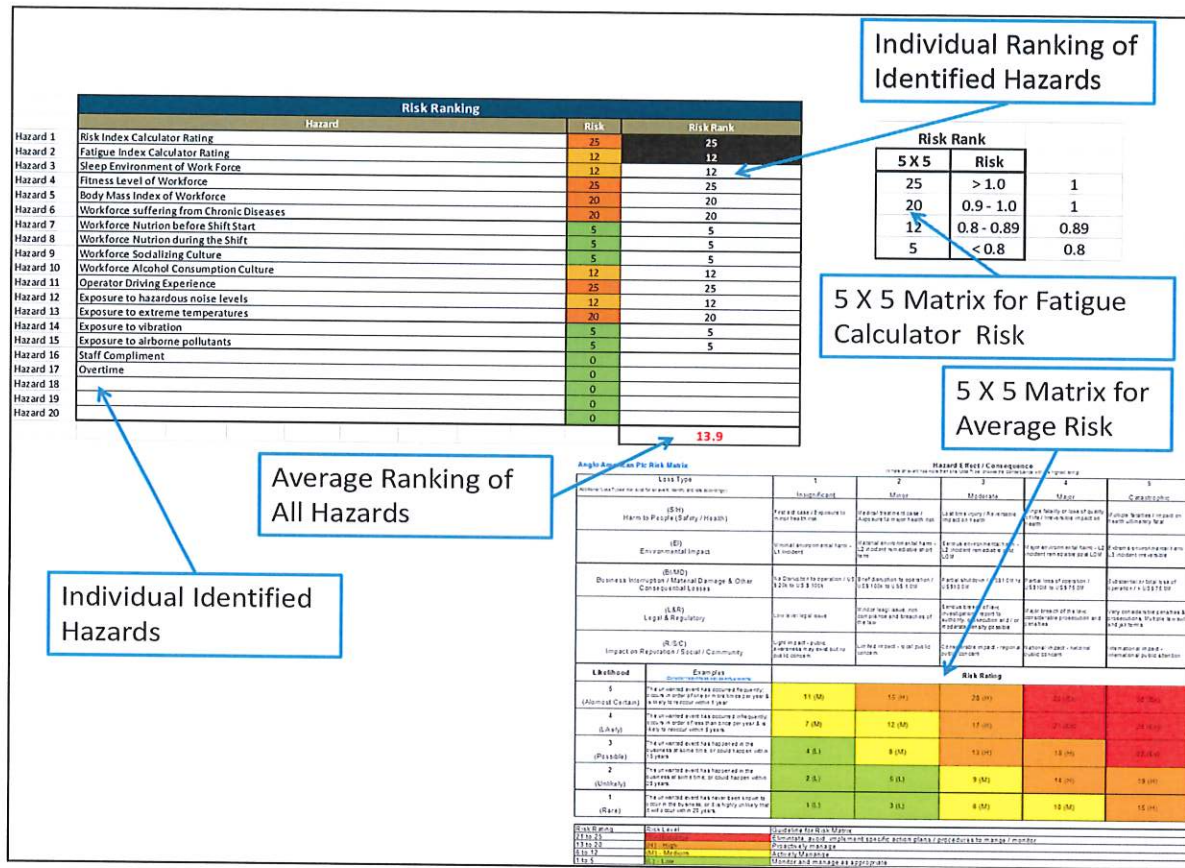


Figure 9: Risk Ranking Table (example)

8.2.4.3 Risk Control: Step 3

8.2.4.3.1 List of Current Controls

The Identified hazards as listed in figure 9 above must be referred to in a "List of current controls" table (figure 10). The controls that exist and currently instituted to mitigate the identified hazard must be logged in the sheet according to the nature of the category in which they fall. The controls that are countermeasures in nature will be listed under the column of countermeasures, controls that are of technology and rostering in nature will also be listed in their respective columns. An inventory list of possible controls can be referred to in the relevant sheet (Tab 3) in the Fatigue and Risk Index Tool.

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	Countermeasures	Technology	Rostering
	Countermeasures	Technology	Rostering
Hazard 1			
Hazard 2			
Hazard 3			
Hazard 4			
Hazard 5			
Hazard 6			
Hazard 7			
Hazard 8			
Hazard 9			
Hazard 10			
Hazard 11			
Hazard 12			
Hazard 13			
Hazard 14			
Hazard 15			
Hazard 16			
Hazard 17			
Hazard 18			
Hazard 19			
Hazard 20			

Figure 10: List of current controls (example)

8.2.4.3.2 Additional Controls

The additional controls need to be identified; an inventory list of possible controls as listed in the possible control sheet can be consulted. Once identified, they can be logged and actioned to be implemented and the responsible person must be identified and sign for action. These controls must be logged into the table as displayed in figure 11 below.

	Recommended controls	Implemented Controls	Responsible Person	Responsible Person
	Recommended Controls	Additional Controls Action Sheet	Responsible Person	Signature
	Class	Controls Implemented	Date Completed	Signature
Hazard 1				
Hazard 2				
Hazard 3				
Hazard 4				

Class Countermeasures Technology Rostering

Signature Column

Figure 11: List of recommended controls (example)

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8.2.4.4 Monitoring & Evaluation: Step 4

The fatigue management plan should be reviewed at regular intervals to ensure that all relevant hazards are included and to assess the effectiveness of the controls. Some of the specific factors to consider as part of the monitoring and evaluation include:

- Have the control measures been implemented as planned?
- Are there any new operational processes that have been introduced?
- Review available fitness, health and EAP and absenteeism data.
- Review incident data.

8.2.4.5 Documentation: Step 5

Documenting Fatigue Management Plan

The fourth step in the fatigue management process is to develop and document a plan detailing how control measures will be implemented. The fatigue management plan should be integrated as part of an overall occupational health and safety programme. The plan should be:

- Specific to the mine site.
- Developed through consultation.
- Publicly available, e.g. on display.
- Communicated regularly and appropriately, e.g. in inductions and safety talks.
- Regularly reviewed to take account of changes in site needs and knowledge about the risks.

It should include:

- A statement of the principles for managing fatigue.
- Roles and responsibilities of all levels of the organization.
- The risk assessments that have been undertaken.
- The risk controls that are and will be in place, along with an implementation plan.
- The support systems that already exist and that will be set up along with an implementation plan, e.g. EAP, training programmes and monitoring systems.

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8.2.5 COMMUNICATION OF THE FATIGUE MANAGEMENT PLAN

Communication of the Fatigue management Programme will include appropriate communication to management, employees and family member/community. Due care will be given to the inclusion of all representative parties and accordingly, employee representatives (unions) are and will continuously be consulted well in advance of the communication in a manner that facilitates support for the program.

	Activity	Responsible	Media
1	Review the Fatigue Management Programme and amend as required	Chairman: FM	Fatigue Management Implementation Plan
2	Engage resident unions to secure agreement and support for the launch and implementation	Chairman: FM Committee	Fatigue Management Implementation Plan
3	Share all communication media with the resident union(s) to ensure clarity of message and agreement thereto.	Chairman: FM Committee	See Communication media on following pages
4	Develop communication program and agree communication approach to include management, employees, unions, family/community	Chairman: FM Committee	See Communication media on following pages
5	Print / Order sufficient quantities of communication material to service the needs of the operation	Chairman: FM Committee	
6	Distribute communication material	Chairman: FM Committee	See Communication media on following pages
7	Continually review and update communication (following the steps as from point 1 above)	Chairman: FM Committee	

8.2.6 INFORMATION, EDUCATION & AWARENESS

Two separate but related initiatives must be undertaken to ensure Information, Education & Awareness is available and effective.

8.2.6.1 Fatigue Management for Employees

Employees will receive formal Fatigue Management Training during initial and annual refresher training, including an assessment, conducted at the BMM Training Centre. Focussed information and awareness on the lifestyle choices that can affect fatigue in the workplace as well as what lifestyle choices can support minimising fatigue are conducted through the Fatigue Management Booklet, Toolbox talks, notice boards, pamphlets, etc.

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8.2.6.2 Family & Community Engagement

In order to create a supportive environment around our employees it is also important to share information with family members and communities in such a way as to foster support for the minimising of fatigue. The Fatigue Management Booklet will form the basis of information and includes lifestyle, home and educational material. Typical activities to structure this program should include:

	Activity	Responsible	Media
Family & Community Information / Communication:			
1	Develop Fatigue Management Information. These could include: - Living with a Night Shift Worker - Sleep Hygiene - Fatigue Management activities	FMC	- Booklets - Pamphlets - Posters
2	Distribute / communicate information to family & community	FMC	
3	Report progress into the EXCO & Joint SHE Committee meetings	Champion: FM EXCO	
4	Review and revise information on a continual basis to ensure applicability and redistribute as and when required	FMC	

8.2.7 MONITORING, REVIEWING & MODIFYING

The FMP will be subject to formal periodic assessments, a minimum of at least every 2 years, to ensure that it remains appropriate and effective, and can address existing and emerging or changed fatigue risks. Targets will be set for key parameters of the FMP. The review will cover the testing and auditing of all aspects of the FMP, in order to determine if controls are meeting business and safety goals. The review should strike an appropriate balance between 'leading indicators' and outcome measures. The following are examples of the former:

- The number of individuals diagnosed and treated with sleeping disorders.
- The number of individuals who self-report fatigue when at work.

The review will also include:

- Incident / accident rates
- Near misses and safety-critical events
- Equipment damage
- Feedback from employees
- Absenteeism
- Staff turnover

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Author:	VOH Manager	Sanction:	General Manager
RISK-BASED FATIGUE MANAGEMENT			

The table below depicts a basic outlay of part of the review:

	Activity	Responsible	Media
1	Having identified the tasks, most prone to fatigue risk, identify appropriate members to participate in the Risk Assessment	Nominated Facilitator	
2	Invite the participants and schedule the date and venue for the Risk Assessment	Nominated Facilitator	
3	Send out the Fatigue Risk Management Base Document to all prospective attendees and advise them to make themselves aware of the content of the documents	Nominated Facilitator	FM Base Document
4	Secure all input documentation for the Risk Assessment from the applicable internal authorities	Nominated Facilitator / HR / Occupational Hygiene	
5	Conduct the Risk Assessment and secure the results for the inherent risk profile of the operation	Nominated Facilitator	Risk Assessment and
6	Having understood the results, refer to the documentation on Countermeasures and apply them where appropriate, to reduce the residual risk.	Risk Assessment team	Countermeasure Checklist
7	Determine the controls that will have the greatest practical effect on the inherent risk rating and apply such controls	Risk Assessment team	
8	Ensure that the residual risk rating, with the newly identified control, reduces the risk rating to within acceptable levels for the operation	Risk Assessment team	
9	Document the outcome of the Risk Assessment and the required actions	Nominated Facilitator	Risk Assessment Report
10	Report the full risk assessment outcome to EXCO and agree on the actions to be taken. Report to Joint SHE Meeting Committee.	Nominated Facilitator	Risk Assessment Report
11	Ensure full consultation with the local Union representatives to secure agreement and support for the implementation of the agreed controls.	Fatigue Management Steering Committee Chairman	
12	Undertake operational planning for the implementation phase of the Fatigue Management plan on site.	Fatigue Management Steering Committee	

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RISK-BASED FATIGUE MANAGEMENT			

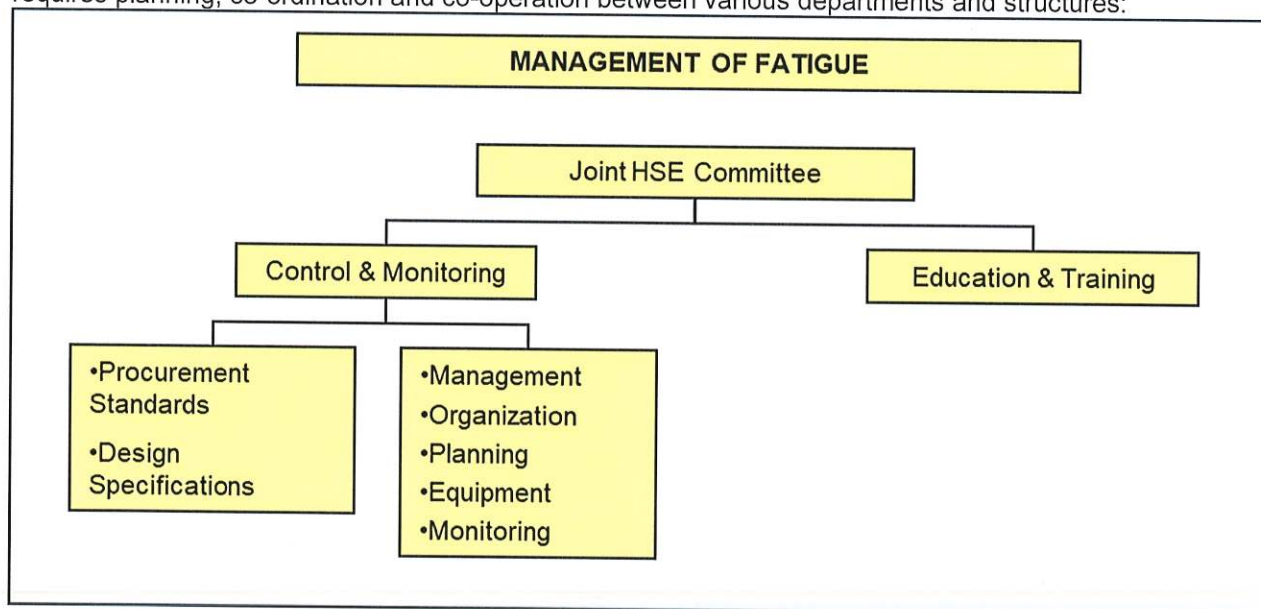
PART D: IMPLEMENTATION.

1. IMPLEMENTATION PLAN.

- 1.1 The employer must prepare an implementation plan for its COP that makes provision for issues such as organizational structures, responsibilities of functionaries and programs and schedules for the COP that will enable proper implementation of the COP. (A summary of/and a reference to, a comprehensive implementation plan may be included).

1.1.1 Management of the Lamp Room & Related Equipment

The overall Management of Fatigue is depicted schematically below. This is an integrated approach that requires planning, co-ordination and co-operation between various departments and structures:

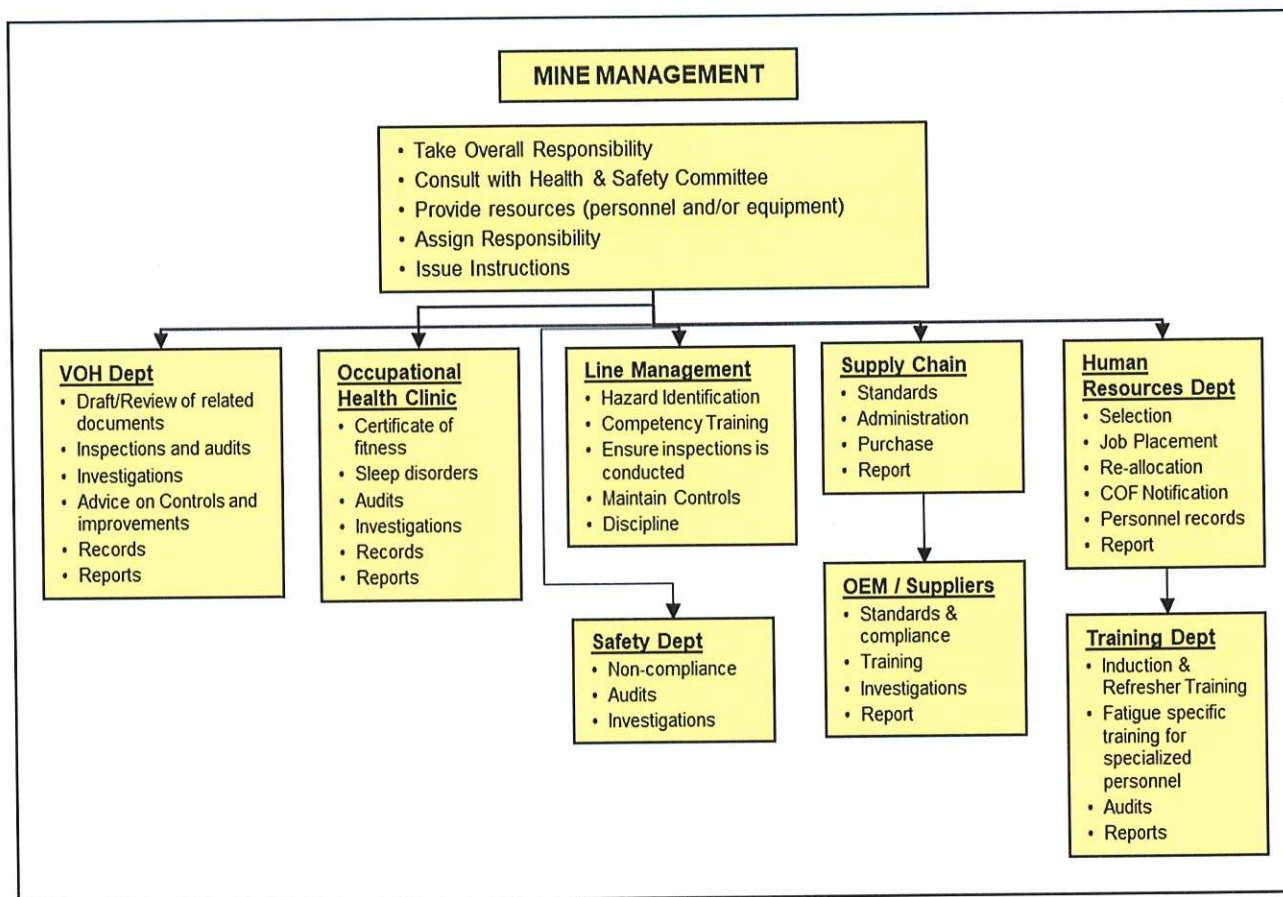


1.1.2 FUNCTIONS & RESPONSIBILITIES

The functions and responsibilities of departments, committees and disciplines are depicted schematically below (see text for details):

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RISK-BASED FATIGUE MANAGEMENT			



1.1.2.1 Mine Management

The owners of the mine must take responsibility for health and safety in terms of the Act. The management of this responsibility is delegated to Mine Management. The Act also requires that a health and safety committee be established for consultation on health and safety issues. This role is fulfilled by the "Joint Health and Safety Committee", which is represented by management and employees.

Other responsibilities relating to the Management of Fatigue include:

- The compilation and implementation of the mine's Fatigue Management policy
- Approval of specific Fatigue Management practices and procedures and the issuing of instructions relating to the implementation of the practices and procedures
- The delegation of responsibilities to designated persons
- Provision of resources in fulfilling the Fatigue Management practices and procedures

1.1.2.2 Training Department: Education & Training

Education & Training is a fundamental prerequisite to the success of the Fatigue Management programme. The purpose is to improve employees' awareness of Fatigue Management, related hazards and its consequences, and to motivate them towards active participation on controlling the risks according to their position and function within Black Mountain.

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RISK-BASED FATIGUE MANAGEMENT			

- a) The objectives of employee induction and education with regards to Fatigue Management practices and procedures are to:
 - Train employees in the hazards of fatigue and how to manage it, sleep requirements, lifestyle impacts
- b) Fatigue Management specialization training:
 - Training must be provided for specific individuals tasked with the management of fatigue.

1.1.2.3 VOH Department

Main functions include:

- a) Document drafting & review
- b) Audits/Inspections and reporting

1.1.2.4 Occupational Health Clinic

Main functions include:

- c) Certificate of Fitness
- d) Sleep disorder identification and management
- e) Audits/Inspections and reporting

1.1.2.5 Safety Department

From a safety perspective the responsibilities include:

- a) Audits and reporting of non-conformances
- b) The administration of compensation for exposure related illnesses

1.1.2.6 Line Management

The main function of Line Management is to create a culture of limiting exposures by:

- a) Continuous hazard identification
- b) Competency training
- c) Maintenance of controls

1.1.2.7 Supply Chain

The contribution of the Supply Chain to the programme is to:

- a) Purchase and supply of approved equipment
- b) In addition to the above, the Supply Chain plays a major part in the acquisition of new equipment with regards to Manufacturers / Suppliers as is shown below.

1.1.2.8 Original Equipment Manufacturers (OEM's) / Suppliers

The contribution of the OEM's / Suppliers to the programme is as follows:

- a) The principle approach to be taken is to control the exposure levels of the equipment supplied to the mine. Section 21 of the MH&S Act is applicable in this regard.
- b) It should be noted that, if an exposure hazard is associated with equipment supplied to mines, the supplier can only relinquish its responsibility with regard to risks if the exposure characteristics of the equipment are specified, the necessary precautions against exposure control are stipulated and the mine management has accepted, in writing, the responsibility of implementing those precautionary measures
- c) Therefore, equipment can only be accepted after the relevant documentation of acceptance has been duly completed

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RISK-BASED FATIGUE MANAGEMENT			

- 1.2 Graphical representations are / will be utilized to facilitate easy interpretation of data and to highlight trends.

2. COMPLIANCE WITH THE COP.

Measures to ensure compliance is instituted through auditing from first, second and third party auditors. Compliance will be measured against the following sections:

3. ACCESS TO THE COP & RELATED DOCUMENTS.

- 3.1 A complete electronic COP, with related documents, is kept readily available at the mine for examination by any affected person. Hard copies, when printed, are treated as uncontrolled copies. Line supervisors and management have direct access to these electronic copies and can distribute it to affected employees when required. On written request to the Manager, any other affected person will be supplied with copies. A register will be kept of such persons or institutions to facilitate updating.
- 3.2 The registered Trade Unions and Full Time Health and Safety Representative will be supplied with copies of this COP on written request to the Manager. A register will be kept of such persons or institutions to facilitate updating.
- 3.3 The employer will ensure that all employees are fully conversant with those sections of this COP relevant to their respective areas of responsibility.

4. Distribution and Access

- The latest revision of this document is available as a read only on the document on the Intranet. The Compliance Officer shall maintain an authorised hard copy of this policy/procedure in the relevant location.
- Line Managers, who have staff reporting to them that do not have access to the Intranet, shall ensure that these personnel are adequately guided and informed.

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Author:	VOH Manager	RISK-BASED FATIGUE MANAGEMENT	

Annexure A: Overtime Hours & Fatigue Shifts

In order to management fatigue, the following will apply:

1. Overtime Hours

Overtime hours will be restricted to 40 hours per employee per month:

- The HR/Payroll system will be utilized to monitor the amount of overtime hours work by each employee
- The system will include an early notification, set at 32 hours, sent to the relevant supervisor informing him/her that an employee is at the 32-hour mark, thus enabling the supervisor to manage the employee's overtime hours
- Should an employee reach 40 hours the system will again send notification to the supervisor as well as blocking an employee to work any further overtime
- Overtime hours can be offset with fatigue (rest) shifts, off which record will be kept in the HR/Payroll system

Note: During emergency situations it could happen that an employee exceeds the 40-hour overtime limit. This will be offset with fatigue (rest) shifts.

2. Fatigue Shifts

A fatigue shift will be issued to any employee that works extra hours after their normal working shift as long as they meet one of the following criteria:

1. Work continuously past their normal shift time to 00:00
2. Was called back to work and works past a time of 02:30



 HR Manager



 VOH Manager

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