HSWA

QUICK GUIDE

Managing health risks in the extractives industry

August 2017

New Zealand Government

WORKSAFE NEW ZEALAND | MAHI HAUMARU AOTEAROA

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ACKNOWLEDGEMENTS

WorkSafe New Zealand (WorkSafe) would like to thank the industry working group for their contribution to the development of this guide.

1.0 Introduction

This guide sets out WorkSafe New Zealand's (WorkSafe) expectations for managing risks to worker health in the extractives industry. It applies to all mining and tunnelling operations, alluvial mines, quarries, coal and mineral exploration and industrial mineral extraction (such as the extraction of perlite).

The guide is for persons conducting a business or undertaking (PCBUs) operating in the extractives industry, senior site executives (SSEs), any person in a safety critical role, mine operators, and anyone else involved in managing risks to worker health in the extractives industry. This includes workers and other persons at the operation.

All mining and tunnelling operations must have a health and safety management system (HSMS). The principal control plan for worker health (Worker Health Plan) is an essential part of the HSMS. This document will help duty holders to develop a worker health control plan.

This is not intended to be a good practice document, nor will it provide comprehensive information on dealing with each of the hazards. More detailed guidance material can be found at: www.worksafe.govt.nz/worksafe/information-guidance/work-related-health

2.0 Legislation

Persons conducting business or undertaking (PCBUs) have a duty under the General Risk and Workplace Management (GRWM) regulations 2016 to manage health risks in the workplace.

Part 1 – General duties

- PCBUs must identify hazards that may be a risk to the health and safety of workers (and other people)
- PCBUs must ensure that effective controls are set up to eliminate or minimise the risk from these hazards; and these controls must be maintained so they remain effective

Part 2 – Management of particular risks

- PCBUs must provide health monitoring where a worker is exposed to substances hazardous to health.

Further to that, Part 3 of the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016 (MOQO Regulations) sets out duties to develop and maintain an HSMS. It describes who should be involved, what the system should include, and requirements for monitoring and review. All extractives operations should already have an HSMS in place.

Similarly, Part 5 of the MOQO regulations describes how to develop control plans and emergency management control plans where principal hazards have been identified. These control plans should be integrated into the larger HSMS.

If the risk assessment identifies one or more principal hazards that may have long term effects on the health of mine workers, a principal control plan for worker health (Worker Health Plan) must be developed by the SSE. Duty holders must provide sufficient resources to implement the Worker Health Plan and ensure the associated equipment is in operational condition and regularly inspected.

Part 5 – Principal Control Plans
Subpart 5 – Worker Health
Regulation 107: Application

This subpart applies to any mining operation where 1 or more principal hazards (see Regulation 65 for definition) have been identified that may have long-term effects on the health of mine workers.

Regulation 108: Worker health control plan

The worker health control plan must, at a minimum, address how the following hazards are to be monitored and controlled where they are present at the operation:

- noise
- vibration
- dust, including asbestos dust, coal dust, silica dust, or mixed dust (being dust that contains mixtures of more than 1 different kind of dust)
- diesel particulates

- fumes, including exhaust fumes, welding fumes, and other fumes arising from metallic sources
- temperature, including extreme hot and cold temperatures, and humidity
- changes in atmospheric pressure
- manual handling and lifting
- hours of work and fatigue
- psychosocial hazards
- ultraviolet radiation
- ionising radiation
- biological hazards
- any other hazard that may adversely affect the health of mine workers who work at the mining operation.

The worker health control plan must also:

- provide for the development of strategies (proportionate to the hazards present at the mining operation and to how a mine worker's behaviour may affect the worker's safety or the safety of others at the mining operation) to deal with fatigue or consumption of drugs and alcohol, and
- set out a detailed process for obtaining urgent medical treatment for mine workers who suffer serious injury or illness at the mining operation, taking into account the nature of the terrain where the mining operation is located and the remoteness of the mining operation from the nearest hospital or other place where medical assistance may be provided.

The requirements for obtaining urgent medical treatment (Regulation 108 (2) (b)) should be included in the Emergency Management Control Plan, and a reference made, instead of recreating the information in detail. See *Emergency Preparedness in Mining and Tunnelling Operations* for more information.

Application to alluvial mines and quarries

Alluvial mines and quarries are not required to manage principal hazards in accordance with the MOQO Regulations. However, there are a number of hazards to worker health within the extractives industry. Whether these are principal hazards or not, alluvial mines and quarries (as PCBUs) must manage risks to health and safety arising from them under HSWA's primary duty of care. WorkSafe recommends that alluvial mine and quarry operators follow the systematic approach to managing health risks set out in this quick guide.

Further duties under the MOQO Regulations

Mining operators (which include tunnel operators) have further duties under the MOQO Regulations, as follows:

- The SSE must engage with workers and health and safety representatives (HSRs) when preparing and reviewing the HSMS or any part of it, including principal control plans (PCPs) and principal hazard management plans (PHMPs).
- The mining operator must document the worker participation practices it is required to have under section 61 of HSWA.
- If a worker reports the existence of a hazard in the operation, the mining operator must:
  - make sure the report is investigated
  - promptly advise the worker of the result of the investigation once completed.

Worker engagement, participation and representation

Under HSWA, as a PCBU all extractives operators must, so far as is reasonably practicable, engage with workers. They must also have effective worker participation practices, regardless of the size, location, hours of operation, or method of extraction.

Under HSWA, an extractives operator must:

- engage with its workers on issues which will or are likely to affect health and safety, and
- have practices that provide reasonable opportunities for its workers to participate effectively in improving health and safety.

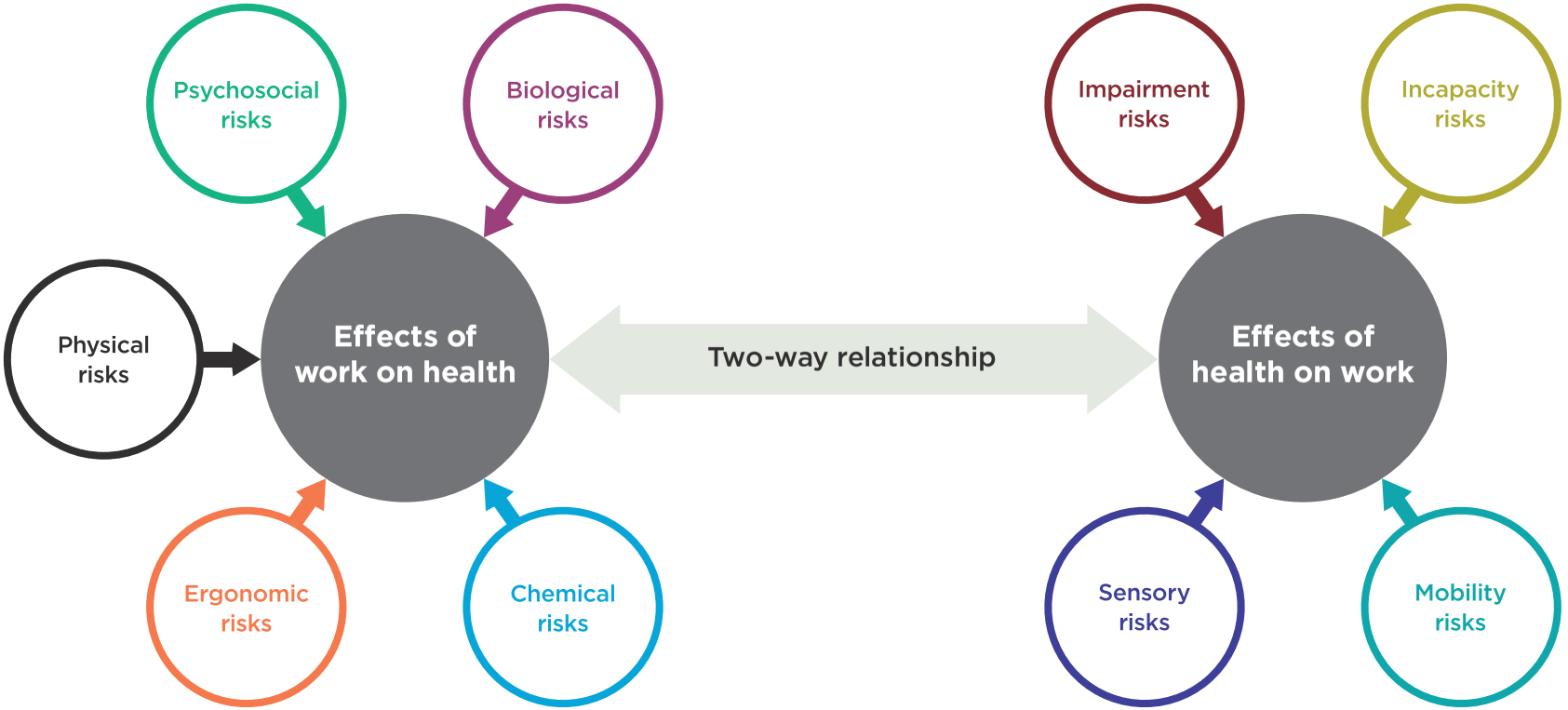
For more information on these duties, see the *Worker Engagement, Participation and Representation* good practice guidelines.

3.0
Managing risk

The purpose of the PCPs, and in this case, the Worker Health Plan, is to develop a system by which health risks can be managed. This system doesn't need to be complex, and it should be flexible, so that new knowledge and technology, or changes in circumstances, can be factored into it. The goal is constant improvement, so that an operation can manage health risks with increasing effectiveness.

Work can affect health and health can affect work. Workers can become unwell or develop poor health from their work environment and activities. Poor health or physical impairment can reduce a worker's ability to work safely, and can impact on other workers' safety.

Figure 1 summarises the effects of work on health and health on work. Include both effects during risk assessment.



WORK-RELATED HEALTH RISKS ('EFFECTS OF WORK ON HEALTH')					HEALTH-RELATED SAFETY RISKS* ('EFFECTS OF HEALTH ON WORK')			
Biological risks	**Chemical risks**	**Ergonomic risks**	**Physical risks**	**Psychosocial risks**	**Impairment risks**	**Incapacity risks**	**Mobility risks**	**Sensory risks**
Blood borne viruses (eg Hep C)	Asbestos	Manual handling	Noise	Bullying and work behaviours	Fatigue	Poorly controlled diabetes	Physical frailty	Colour vision deficiency
Animal bacteria (eg Leptospira)	Solvents	Shift work	Vibration	Excessive workload	Stress or mental distraction	Poorly controlled heart disease	Bone and/or joint conditions	Reduced visual acuity
Bacterial infection	Pesticides	Job design	UV radiation (eg sun exposure)	Lack of autonomy	Drugs/alcohol consumption	Poorly controlled high blood pressure	Severe obesity	Reduced hearing capability

FIGURE 1: Examples of the effects of work on health and health on work

* Health-related safety risks are specific to the tasks, situation and work environment that they exist within and are not a risk in all circumstances.

Plan Do Check Act

WorkSafe encourages PCBUs to use the PLAN-DO-CHECK-ACT approach described in Figure 2 when managing health risks.

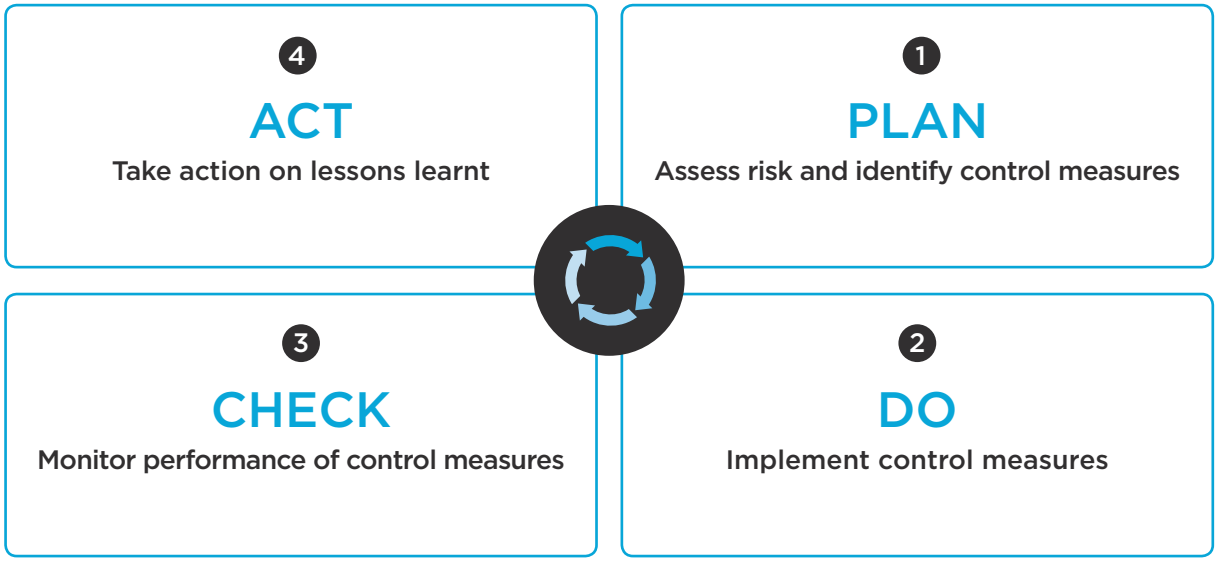


FIGURE 2: Plan Do Check Act

This approach splits risk management into four parts.

Plan

- Identify hazards that could reasonably foreseeably create a risk to health and safety
- Assess each risk and identify control measures
- Assess the likelihood of it happening in your workplace – could it happen to your workers?
- Engage workers and representatives to identify reasonably practicable control measures.

Do

- Implement control measures
- Implement control measures to effectively minimise the likelihood of the risk happening.

Check

- Monitor performance of control measures
- Monitor health of workers and exposure of workers to health risks
- Implement appropriate means for workers to report new hazards and risks and changes to existing ones.

Act

- Take action on lessons learnt
- Take action on exposure and health monitoring results
- Routinely review the effectiveness of control measures at scheduled periods
- Review incidents and talk to your workers to check that the control measures are effectively minimising the risk.
- Use the results of your reviews and investigations into incidents to improve control measures.

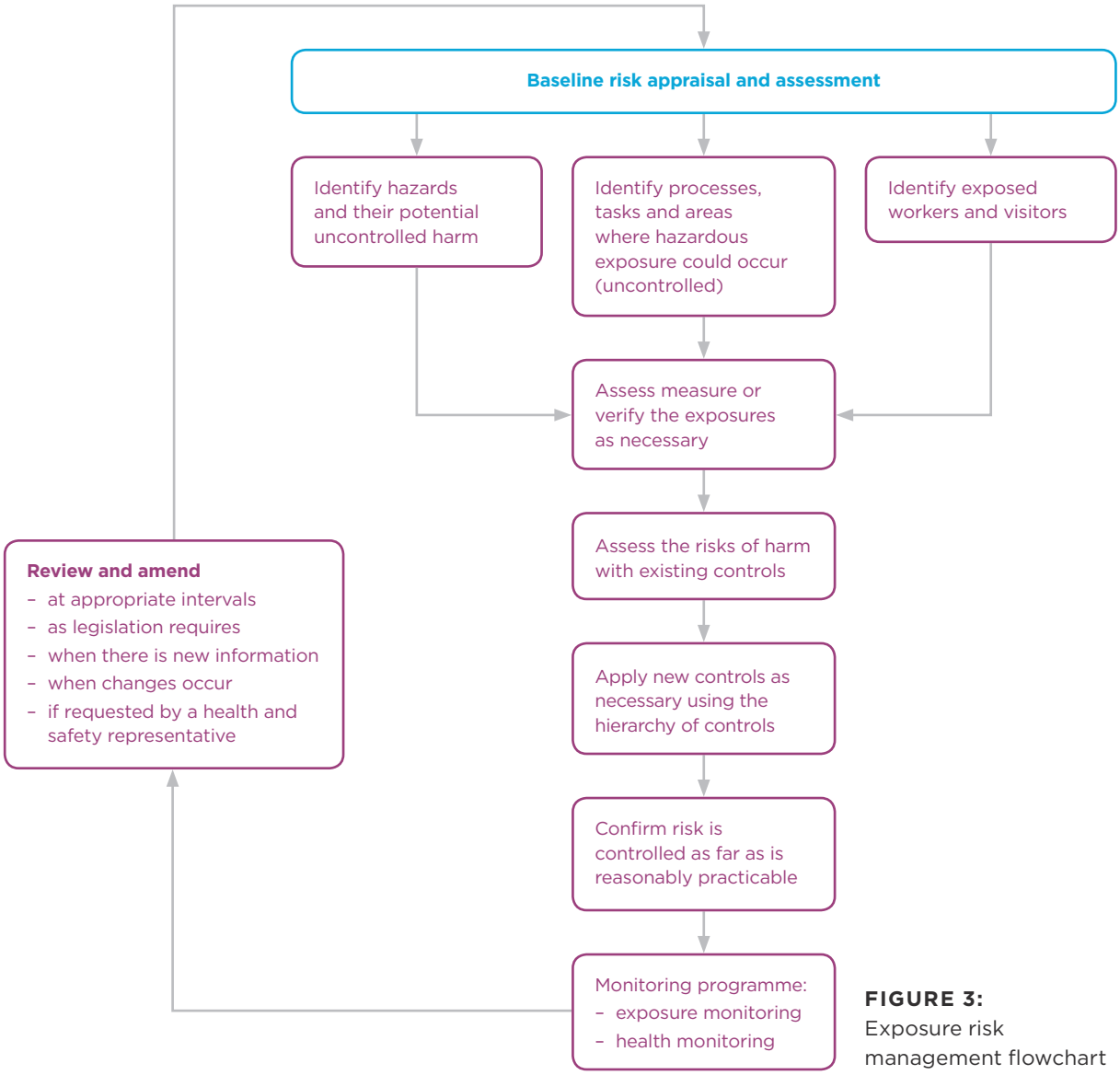


FIGURE 3: Exposure risk management flowchart

Plan

The first step is to identify hazards at the site. Look at the whole operation from a high level and work down. Work-related health risks can be harder to identify, as they can be invisible and effects may take years to impact on a worker's health.

Engage workers with a range of experiences and expertise, including health and safety representatives, to work on identifying hazards. They need to follow a systematic approach to identify all potential hazards. Examples of identification methods include:

- consulting workers
- inspecting the workplace
- reviewing available information (eg from the HSMS, and Safety Data Sheet (SDS))
- asking 'What could potentially harm a worker's health in this workplace or through the work they do?'

Once you have identified the health hazards, develop some high level policies for each. These should be clear statements of commitment to managing health risks, and include broad aims and performance targets for each one. Each policy should be reinforced through periodic review and involvement of management.

Once you've identified each hazard, you must assess the risks of it causing harm. This means assessing likelihood and consequence. More information on work-related health risk assessment in mining can be found in the International Council on Mining and Metal's Good Practice Guidance on *Occupational Health Risk Assessment*.

As health hazards are often invisible (eg noise or respirable particulates), assessing the levels of exposure usually requires measurement. Health effects can take a long time to appear, therefore you also need to put in place policies and systems for health monitoring and exposure monitoring.

Advice on health monitoring and exposure monitoring can be found in Section 4.

Once the hazards have been identified and risk assessed, you must decide which control measures are most appropriate. Apply the hierarchy of controls as set out in the Health and Safety at Work (General Risk and Workplace Management (GRWM)) Regulations 2016. Try to eliminate risks so far as is reasonably practicable. If elimination is not reasonably practicable, the risk needs to be minimized, so far as is reasonably practicable. The hierarchy is shown below.

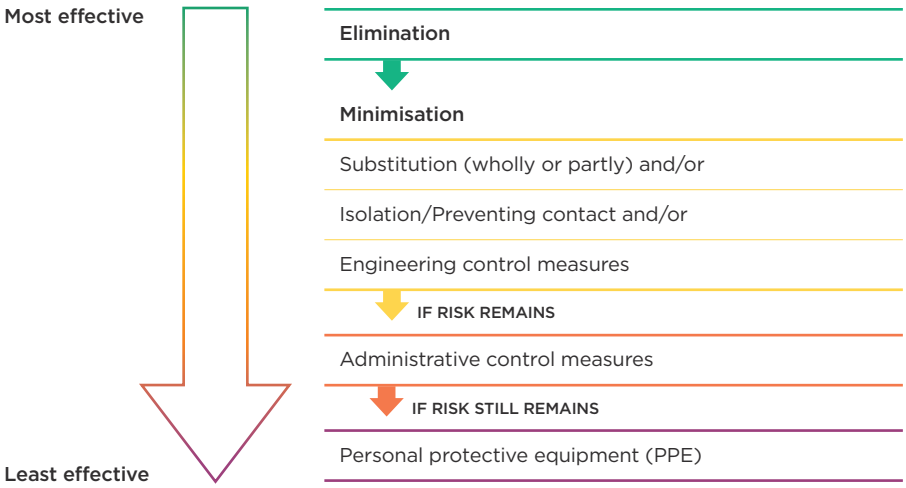


FIGURE 4:
Hierarchy of controls

ACTION		WHAT IS THIS?
Eliminating		Removing the sources of harm (eg equipment, substances or work processes).
Minimising	Substituting	Substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk (eg using a less hazardous thing, substance or work practice).
	Isolating/preventing contact or exposure to risk	Isolating the hazard giving rise to the risk to prevent any person coming into contact with it (eg by separating people from the hazard/preventing people being exposed to the hazard). Isolation focuses on enclosing the hazard or enclosing people to keep them away from the hazard. It can also refer to removing the source of the health risk to an area where workers do not normally work; for example, outside the workplace.
	Imposing engineering control measures	Using physical control measures including mechanical devices or processes.
	Imposing administrative control measures	Using safe methods of work, processes or procedures designed to minimise risk. It does not include an engineering control measure; or the wearing or use of personal protective equipment.
	Using personal protective equipment (PPE)	Using safety equipment to protect against harm. PPE acts by reducing exposure to, or contact with, the hazard.

TABLE 1:
Defining the hierarchy of controls

Each of the hazards itemised in Regulation 108 of the MOQO regulations has its own section in this guide, with examples of controls you could apply.

Do

This is where the control measures decided upon are to be applied. In the hierarchy, minimising means taking one or more of the following actions that is the most appropriate and effective taking into account the nature of the risk:

- substituting with a lower risk activity
- isolating people from the hazard/preventing people being exposed to the risk
- applying engineering control measures.

If a risk then remains, you need to minimise that risk, so far as is reasonably practicable, by putting in place administrative control measures like shift rotation or regular plant maintenance. PPE is also essential and effective in many situations and should be used in addition to higher hierarchy controls.

One risk could need multiple controls to adequately manage it.

Check (monitoring and review)

The main aspects to performance monitoring are:

- monitoring activities carried out within the Worker Health Plan
- monitoring and measuring the performance of controls
- evaluating if the monitored performance is suitable and achieves the desired outcomes

- investigating any non-compliance found
- reviewing the results of health and exposure monitoring
- reporting performance monitoring and any necessary corrective action
- implementing corrective action to ensure ongoing performance is to a suitable standard
- following up what was monitored and reported is accurate and any corrective actions to be taken.

Mining operations should judge the effectiveness of their systems by how well the risk is being managed rather than by reports of injury or ill health.

You should consider using a combination of performance standards which set both:

- leading indicators (that measure the activities or inputs of the organisation to managing health and safety)
- lagging indicators (that measure the outputs or actual performance achieved).

In setting performance standards consider the following questions:

- How will I know that this particular system or control is working effectively?
- Alternatively, what will tell me the system or control is not working?

Performance standards should be detailed and transparent. They should be defined in such a way as to provide a meaningful measure of effectiveness.

LEADING PERFORMANCE INDICATORS

Leading indicators monitor the design, development, and operation of management arrangements. These tend to be preventative in nature, for example:

- routine inspections of premises, plant and equipment by staff
- workplace exposure monitoring to assess risk
- planned function check regimes for key pieces of plant
- number of new or enhanced health and safety controls implemented
- results of observations and accident investigation results
- risk assessments and job hazard analysis.

LAGGING PERFORMANCE INDICATORS

Lagging indicators monitor evidence of poor performance but can also identify better practice, for example:

- investigating incidents and incidents monitoring the health of workers
- monitoring cases of ill health and sickness absence records
- non-compliance issues.

Act (revising the plan)

94 Review and revision of principal control plans

In addition to the requirements of regulation 58, the site senior executive must ensure that each principal control plan is reviewed at least once every two years after the date on which the principal control plan is made.

In addition to the requirements of regulation 59, the site senior executive must ensure that a principal control plan is reviewed after:

- the occurrence of an accident at the mining operation involving any hazard that the principal control plan was intended to manage:
- a material change in the management structure at the mining operation that may affect the principal control plan:

- a material change in plant used or installed at the mining operation that may affect the principal control plan:
- the occurrence of any other event identified in a principal control plan as requiring a review of the plan.

In addition to the requirements of regulation 61, the mine operator must ensure that records of all reviews and revisions of principal control plans are kept for at least 12 months from the date on which the mining operation is abandoned.

The mine operator must, on request, provide records relating to a review of a principal control plan to an inspector or a health and safety representative.

95 Audits of principal control plans

The mine operator must engage, and pay for, a competent person to carry out an independent external audit of all principal control plans, ensuring that:

- external audits are carried out once every three years after the date on which the principal control plan is made; and
- the external auditors are independent of the mining operation.

In addition to the requirements of regulation 61, the mine operator must ensure that results of all audits of principal control plans are kept for at least 12 months from the date on which the mining operation is abandoned.

While the MOQO regulations outline minimum frequency at which to review and audit the HSMS and any principal control plans, it's important to act immediately to improve controls and processes whenever problems are identified, or when the opportunity to upgrade is presented. Good monitoring of all processes and controls will help with this. Revise your plan and controls whenever monitoring indicates an opportunity to do so.

Integrating the Worker Health Plan into your HSMS

The Worker Health Plan will potentially be one of a number of PCPs you develop to manage principal hazards. Each of those is a part of the larger health and safety management system for the work site. Note that where a company or organisation has operations on several sites, it's vital to tailor health and safety systems and plans to the needs of each separate site.

Ensure your communication and systems are consistent for every part of an HSMS, including the principal control plans. Engage workers and health and safety representatives in the development, and make sure they're up to date with any changes to the systems.

Workers should be provided with adequate training on Worker Health Plans, and the larger HSMS. This should be covered initially within their induction, and periodically throughout their employment to ensure workers understand the hazards and how these hazards are managed. Emergency response should be tested regularly.

Record keeping is another aspect of safety management that should be consistent across every part of your HSMS. Keep records for at least seven years, and make sure they're backed up off-site.

4.0 Health monitoring and exposure monitoring

Health monitoring is the monitoring of workers to identify any changes in their health status because of exposure to certain health hazards. As part of their primary duty of care, a PCBU must ensure so far as reasonably practicable, that workers health (and the health of other persons) is not put at risk by its work. Health monitoring allows a PCBU to effectively monitor this risk. It includes:

- hearing testing
- respiratory function testing
- testing for the effects of solvents.

Mine operators have duties to provide health monitoring for workers. See section 127 of MOQO Regulations 2016 for further information.

Exposure monitoring is the measurement and evaluation of exposure to a health hazard experienced by a person at work. It includes measuring exposure to:

- substances hazardous to health in the air (eg dust and other particulates)
- noise
- vibration.

Exposure monitoring might include measuring levels of a substance in air, levels of noise, heat, vibration, or levels of substances in the blood or urine.

Both health monitoring and exposure monitoring may be necessary to assess if a risk is being appropriately managed. Exposure monitoring in particular is useful in the risk assessment phase to help determine how great the risk and what level of control you need.

Health monitoring detects how much harm a worker has already suffered, but does not provide information on the level of risk the worker is still being exposed to. Wherever exposure monitoring is needed, it is likely that health monitoring is also needed. Health monitoring provides information on whether the controls in place to reduce harm to health are working adequately.

Where can you find further information?

For more information refer to:

- *Exposure Monitoring under the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016*
- *Health Monitoring under the Health and Safety at Work (General Risk and Workplace Management) Regulations 2016*.

5.0 Hazards

Noise

Describe the hazard

Noise induced hearing loss (NIHL) is permanent and has a significant impact on a worker's life. People with NIHL can lose their jobs, spend more time away from work, not perform as well as others, miss out on promotions or other jobs, and have difficult social and family relationships.

Loud noise can have serious and permanent long-term effects on hearing and is a common problem in the extractives industry. Hearing loss can have a major impact on both work and social life, leading to isolation and depression. Loud noise can also lead to tinnitus, a persistent ringing or buzzing in the ears.

Noise is one of the most significant health hazards in the extractives industry.

Plan

HOW CAN YOU ASSESS THE RISK?

There are two types of noise assessment; a preliminary noise assessment and a detailed noise assessment. A preliminary noise assessment helps to identify noise risks. It does not usually require sophisticated equipment or specially trained personnel. They are used as an initial assessment tool for identifying noise. If the preliminary noise assessment identifies noise levels that could meet or exceed noise standards then a detailed noise assessment must be conducted.

Undertake further assessment:

- if there is a change in work arrangements that may increase noise levels (eg new plant)
- otherwise, if it has not occurred more frequently, every five years.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		Eliminating noise source.
Minimising	**Substituting**	Buying quiet plant, equipment, and vehicles.
	Isolating/preventing contact or exposure to risk	Isolating noise from workers, or workers from noise (eg sound proofed operating booth).
	Imposing engineering control measures	– Fitting silencers (eg mufflers or enclosures). – Providing acoustic barriers.
	Imposing administrative control measures	– Performing regular maintenance to reduce noise from friction, vibrating surfaces, mechanical impacts, high velocity air flow or liquid flow, and fan blades. – Moving workers further away from noise sources.
	Using personal protective equipment (PPE)	Providing hearing protection, and training on its use and ensuring that it fits properly.

Selection of controls should follow the hierarchy of controls and not default to hearing protection. If hearing protection is being used as the primary control you should be able to show that ways of eliminating noise or minimising it using methods higher up the hierarchy of control are not reasonably practicable.

Where a detailed noise assessment shows that noise levels are above the exposure limits (see WorkSafe's Approved Code of Practice for the *Management of Noise in the Workplace*), or for any reason it is assumed that noise levels are above the exposure limits, you should offer pure tone audiometric testing to workers every year. This needs to be done whether workers wear hearing protection or not.

The testing needs to include a hearing conservation programme with the following components:

- monitoring program
- audiometric testing program (including baseline testing)
- Hearing Protection Devices (HPDs)
- employee training and education
- recordkeeping.

Testing is to be conducted to the requirements of AS/NZS 1269 series. If testing is conducted on site, provide testing facilities that meet the maximum permissible ambient noise limit, as outlined in the standard.

Where can you find further information?

For more information refer to:

- WorkSafe's Approved Code of Practice for the *Management of Noise in the Workplace*

AS/NZS 1269.2:2005 – *Occupational noise management – Noise control management*

Vibration

Describe the hazard

There are two health hazards relating to vibration, these are:

- whole body vibration
- hand-arm vibration.

Whole-body vibration occurs when vibration is passed through the body from a surface where a worker sits or stands. This occurs most often in workers driving machinery or other vehicles over rough or uneven surface. Whole-body vibration can affect the body in several ways and can cause a number of health disorders.

Hand-arm vibration occurs when vibration is passed through the hands and arms, usually from hand or power tools. Permanent damage to blood vessels, nerves and joints can be caused by repeated vibrations from hand and power tools.

Hand and power tools send vibrations through the hands and arms. Vibrating surfaces, where a worker sits or stands, can send vibration throughout the whole body. Permanent damage to blood vessels, nerves and joints can be caused by repeated vibrations from hand and power tools.

In the extractives industry, vibration is seen as having a high potential to damage worker health.

WorkSafe has adopted the exposure guidance in the European Union Directive 2002/44/EC (2002) on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration) for addressing vibration.

There is:

- a maximum daily exposure limit of Vibration Dose Value (VDV) = 21 $m/s_{1.75}$
- an action level of VDV = 21 $m/s_{1.75}$, which if reached or exceeded requires an employer to take specific actions to reduce exposure.

Plan

HOW CAN YOU ASSESS THE RISK?

Vibration needs to be assessed by a competent person with specialist training and experience. This could be an occupational hygienist who specialises in vibration assessment.

Ensure vibration is assessed to the requirements of:

- AS 2670.1 *Evaluation of human exposure to whole-body vibration – General requirements*
- AS ISO 5349.1 *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – General requirements*
- AS ISO 5349.2 *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Practical guidance for measurement at the workplace*
- ISO/TR 25398 *Earth-moving machinery – Guidelines for assessment of exposure to whole-body vibration of ride-on machines*.

When carrying out an assessment, ensure workers are consulted about their experiences with vibration to identify potentially damaging vibration.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		Remove vibration source.
Minimising	**Substituting**	– Buy tools, plant, and vehicles that produce less vibration. – Use methods of work that produce less vibration (eg abrasive blasting instead of needle guns, hydraulic rather than compressed air wrenches, using a cut off saw instead of an angle grinder).
	Isolating/preventing contact or exposure to risk	Use methods that do not require using hand tools (eg tools operated by remote).
	Imposing engineering control measures	Vehicle and seat design.
	Imposing administrative control measures	– Road and vehicle maintenance. – Speed limits. – Operator training and awareness. – Equipment exposure limits are set. – Equipment change out and swap arrangements are in place (as required). – Organise work and design workstations to avoid uncomfortable postures, vibration, or body stressing, and the need for high manual effort to handle equipment. – Maintain tools regularly. – Limit the time workers are exposed to vibration (job rotation).
	Using personal protective equipment (PPE)	Keep workers warm (eg gloves) and provide appropriate PPE.

Where can you find further information?

For further information see:

- *Bad Vibrations - A Handbook on Whole-Body Vibration Exposure in Mining*
- Safe Work Australia's:
  - *Guide to measuring and assessing hand arm vibration*
  - *Guide to measuring and assessing whole body vibration*.

Airborne dust

Comprehensive information on monitoring exposure and selecting and implementing controls for respiratory health risks can be found in WorkSafe's Approved Code of Practice on *Air Quality in Extractives*.

Describe the hazard

Airborne dust is present in most extractives sites. An assessment for dust will be needed for most sites. Risks to worker health from dusts must be managed, including:

- silica dust
- coal dust
- metal dust
- asbestos dust
- other hazardous inhalable or respirable dusts.

Respirable dust is dust that penetrates to the unciliated airways when inhaled.

Where can you find further information?

For further information see:

- WorkSafe's Approved Code of Practice on *Air Quality in Extractives*
- Approved Code of Practice for the *Management and Removal of Asbestos*.

Diesel particulates

Diesel particulate matter is part of a complex mixture that makes up diesel exhaust. Diesel exhaust emissions are particularly hazardous in places without enough ventilation to dilute them (eg in workshops or underground).

Emissions can also accumulate in surface operations if there is not enough wind to disperse them (eg in the pit).

Comprehensive information on monitoring exposure and selecting and implementing controls for respiratory health risks can be found in WorkSafe's Approved Code of Practice on *Air Quality in Extractives*.

Describe the hazard

Short-term acute symptoms include headaches, dizziness, light-headedness, nausea, coughing, difficult or laboured breathing, tightness of chest, and irritation of the eyes, nose and throat. Long-term exposures can lead to chronic, more serious health problems such as cardiovascular disease, and cardiopulmonary disease. Diesel exhaust is recognised as a carcinogen.

Where can you find further information?

For further information see:

- WorkSafe's Approved Code of Practice on *Air Quality in Extractives*.

Fumes

Fumes are an aerosol of solid particles condensed from the vapour state (eg vapourised metals from welding condensing to form solid particles in the air). They can result from blasting or welding in a mining operation. Fumes contain hazardous gases including:

- carbon monoxide
- oxides of nitrogen, including nitric oxide and nitrogen dioxide
- hydrogen sulphide
- sulphur dioxide
- ammonia.

Comprehensive information on monitoring exposure and selecting and implementing controls for respiratory health risks can be found in WorkSafe's Approved Code of Practice on *Air Quality in Extractives*.

Describe the hazard

The health effects of welding fumes and gases depend on their composition. They can include metal fume fever (a short-term painful ailment with symptoms of fever and chills), chronic obstructive lung disease, pneumoconiosis (lung disease due to accumulation of mineral or metallic particles), occupational asthma, and irritation of the eyes and respiratory tract.

Where can you find further information?

For further information see:

- WorkSafe's Approved Code of Practice on *Air Quality in Extractives*.

Temperature

Describe the hazard

Exposure to extreme temperatures can be a serious cause of harm to people. Exposure to low temperatures can cause hypothermia, frostbite, loss of extremities and death. High temperatures can cause heat strain and the rapidly fatal heat stroke.

High temperatures can occur:

- in humid environments
- in areas of poor air circulation
- where a lot of physical activity is occurring
- where warm or heavy clothing is being worn
- near to a source of radiant heat (eg heavy machinery or a generator).

Low temperatures can occur:

- in wet conditions (eg rain, in standing or flowing water)
- at night
- in high wind conditions (natural or mechanical)
- in alpine regions
- outdoors
- in open vehicles.

Plan

HOW CAN YOU ASSESS THE RISK?

Establish a temperature plan for assessing and managing extreme temperatures. WorkSafe recommends that if Basic Effective Temperature (BET) exceeds 28°C the health of mine workers should be managed by meeting the Australian Institute of Occupational Hygienists (AIOH) heat stress standard.

The AIOH guidelines recommend a stepwise heat stress risk assessment. The first step is to use a simple measure such as apparent temperature, WBGT (wet bulb, globe, temperature), or BET and at this stage consider clothing type, acclimatization and metabolic rate from a qualitative perspective.

If the first step indicates risk then detailed assessment is required using a rational heat stress index such as the ISO 7933 Predicted Heat Strain or Thermal Work Limit. Depending on the result of the Step 2 assessment, either identified controls are put in place, and/or physiological monitoring is undertaken, or work limitations are applied.

If ET exceeds 30°C, workers should not work in the mine unless carrying out work in an emergency situation to a Standard Operating Procedure.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	**Substituting**	
	Isolating/preventing contact or exposure to risk	
	Imposing engineering control measures	
	Imposing administrative control measures	– Establishing a plan for assessment and management of temperature extremes – Training.
	Using personal protective equipment (PPE)	Warm clothing for cold temperatures.

Where can you find further information?

For more information see:

- WorkSafe's *Guidelines for work in extremes of temperature*
- *Confined spaces: Planning entry and working safely in a confined space*
- Australian Institute of Occupational Health: *A guide to managing heat stress: developed for use in the Australian environment*
- Government of Western Australia Department of Mines and Petroleum *Heat Stress* toolbox presentation
- *ISO 7933 Predicted Heat Strain or Thermal Work Limit*.

Atmospheric pressure

Describe the hazard

Working in compressed air in tunnels, shafts and caissons can present health risks to workers. Decompression sickness (also known as divers' disease, the bends or caisson disease) is a condition arising from dissolved gases coming out of solution into bubbles inside the body on depressurisation.

Bubbles can form in or migrate to any part of the body. The symptoms and effects of decompression sickness vary from joint pain and rashes to paralysis and death. Individual susceptibility can vary from day to day. Different individuals can be affected differently or not at all under the same conditions.

Differences in atmospheric pressure can cause seals in underground mines to leak into active areas. For surface operations, nearby underground workings can release oxygen depleted air, particularly when there is a low pressure weather cell or temperature inversion on a cold morning.

Plan

HOW CAN YOU ASSESS THE RISK?

Measure atmospheric pressure using the methods in AS 4774.1-2003. Specialist advice from a competent person may be needed to assess and manage risks from atmospheric pressure.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	**Substituting**	
	Isolating/preventing contact or exposure to risk	
	Imposing engineering control measures	
	Imposing administrative control measures	– Establishing a plan for assessment and management of temperature extremes – Training.
	Using personal protective equipment (PPE)	

Ensure that work in compressed air to be carried out in accordance with a safe system of work, and that health surveillance is applied under the advice of a competent medical advisor.

Compression and decompression must be carried out safely and in accordance with AS 4774.1-2003 as a minimum. Training for persons entering or working in the compressed air environment must meet the specified topics listed in AS 4774.1-2003.

WorkSafe recommends that the safe system of work is developed based on a combination of information given in AS 4774.1-2003, and the UK and Singapore regulations.

Ensure that decompression chambers meet the requirements of *Rules for Classification and Construction VI– Other Operations and Systems Part 4 – Chamber Systems for Tunnelling*.

Where can you find further information?

For more information see:

- AS 4774.1 *Work in compressed air and hyperbaric facilities – Work in tunnels, shafts and caissons*
- Work in Compressed Air Regulations 1996 (UK)
- Workplace Safety and Health (Construction) Regulations 2007 (Singapore)
- Rules for Classification and Construction VI– Other Operations and Systems Part 4 – Chamber Systems for Tunnelling.[1]

[1] www.gl-group.com/infoServices/rules/pdfs/gl_vi-11-4_e.pdf

Manual handling

Describe the hazard

Manual handling is defined as: 'any activity requiring a person to lift, lower, push, pull, carry, throw, move, restrain, hold or otherwise handle any animate, or inanimate, object'. This hazard needs to be assessed on every extractives site.

Risks from manual handling include:

- serious back injuries
- musculoskeletal disorders – including occupational overuse syndromes
- acute injuries such as sprains and strains of muscles or tendons
- injuries sustained through slips, trips and falls.

There is some evidence that manual handling is one of many inter-related risk factors for acute low back pain.

Plan

HOW CAN YOU ASSESS THE RISK?

There are several types of manual handling tasks that could cause harm, including:

- lifting/lowering tasks
- pushing/pulling tasks
- upper limb disorders
- carrying and throwing tasks
- tasks requiring repetitive actions.

A task may fall into more than one category and require assessment against multiple criteria (eg maintenance tasks).

If there is any doubt whether a task is hazardous, carry out an assessment. Ideally, all manual handling tasks will be fully assessed. The use of pre-employment medical assessments for workers may assist an operator in determining whether there is increased risk for a worker involved in manual handling tasks.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	Substituting	
	Isolating/preventing contact or exposure to risk	
	Imposing engineering control measures	– Incorporate an integrated lifting device in the design or – Be provided with special lifting gear attachments.
	Imposing administrative control measures	– Label all components and consumables over 10 kg with their weight. – Devise ergonomic analysis and solutions for all tasks and equipment. – Establish weight limits on loads to be lifted manually. – Rotate work rosters to limit time spent on tasks involving repetitive actions.
	Using personal protective equipment (PPE)	

However, the general principle is that the hazardous manual handling task needs to be as easy as possible. Injuries occur because of strain on the body, especially strain on the lower back. Easier tasks strain the body less.

General principles for reducing strain include:

- using mechanical assist devices
- reducing weight being handled
- handling objects close to the body
- ensuring work is performed in an upright position
- using good lifting techniques
- ensuring manual handling area is uncluttered.

Where can you find further information?

For more information see:

- WorkSafe's Code of Practice for *Manual Handling*
- Health and Safety Executive's:
- *Manual Handling at Work: A brief Guide*
- *Upper limb disorders in the workplace*
  - Manual Handling Assessment Charts (MAC) Tool
  - Variable Manual Handling Assessment Chart (V-MAC) Tool
  - Assessment of Repetitive Tasks (ART) Tool
  - Risk Assessment of Pushing and Pulling (RAPP) Tool.

Fatigue

MOQO Regulation 108 (2)(a) requires that strategies are developed to deal with fatigue. These strategies must be proportionate to the hazards at the mining operation and to how a worker's behaviour could affect their or others' safety.

Describe the hazard

Fatigue is a risk in the extractives industry with the introduction of 24 hour operations and 12 hour shifts. With more focus on commuting accidents and fatalities, there is growing concern about the effect of fatigue on mine workers and on general road users.

With the introduction of 24 hour operations and 12 hour shifts, the risk of fatigue in extractives workers has increased. This risk applies to workers who experience fatigue during work hours, as well as those who experience fatigue outside of work hours. Workers may become fatigued during work hours as a direct result of their work, or by coming to work already fatigued. There is growing concern for workers who experience fatigue outside of their work hours, particularly when commuting to or from work.

As the need for sleep builds up, mental and physical impairment can result, leading to errors in decision making and safety. Micro-sleeps, where the person falls asleep briefly, are potentially deadly if they occur at the wrong time.

While a worker can experience fatigue at any time of day, peak injury times are midnight, 3 am and 5 am.

Long shift hours both increase worker fatigue and decrease recovery time. Thus long shifts have a cumulative impact on worker health.

Plan

HOW CAN YOU ASSESS THE RISK?

Establish a fatigue management plan if fatigue is a hazard. 24 hour operations will have fatigue as a hazard, as they operate at night. Mine operators must establish a fatigue plan as part of the Worker Health Plan. Consider the physical and mental demands of the work and how this may require changes to shift length.

The plan needs to specify, at least:

- minimum hours of sleep opportunity between shift (at least two full nights to reduce the likelihood of fatigue.)
- maximum shift length, considering:
  - time of day
  - type of work
  - underground or surface based work
- maximum travel time before and after a shift
- maximum hours to be worked in a week
- maximum hours to be worked in a month
- procedures for detecting, reporting and addressing fatigue, if it occurs.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	**Substituting**	
	Isolating/preventing contact or exposure to risk	
	Imposing engineering control measures	
	Imposing administrative control measures	– Developing a fatigue management plan, taking into account shift design and hours of work. – Training workers on fatigue management. – Ensuring shift length and rotation rules are not compromised. – Encourage open communication with workers to discuss psychosocial pressures.
	Using personal protective equipment (PPE)	

Where can you find further information?

Tools for assessing fatigue:

- HSE's Fatigue and Risk Index
- SCIRT's Fatigue Scorecard
- NSW's Fatigue Risk Management Chart
- NSW Department of Industry Resources and Energy's *Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry*.
- SWA's *Fatigue management – a worker's guide*.

Additional guidance on fatigue is available on WorkSafe's website.

Psychosocial hazards

Describe the hazard

Psychosocial risks can include stress, bullying, harassment, violence and work demands. They can have a serious effect on workers and workplace health and safety. They can affect workers physically and mentally and cause:

- increased stress levels
- decreased emotional wellbeing
- reduced coping strategies and lower work performance.

Psychosocial effects can reduce productivity and disrupt workplaces through:

- impaired performance
- increased absence
- low morale
- more mistakes and accidents
- loss of company reputation
- resignations and difficulty recruiting
- poor customer service/product quality.

Psychosocial risks are factors with the potential to cause harm, which arise from the design and management of work, and its social and organisational context. These factors include the design, content, scheduling, and control of work, and interpersonal relationships.

Creating a healthy workplace is the best way to prevent psychosocial hazards.

Plan

HOW CAN YOU ASSESS THE RISK?

Mining and quarrying are not necessarily at a greater risk of psychosocial hazards than other industries. However, shift work and a high hazard environment could amplify their effects.

The risks are clear, but incidents cannot be predicted. Therefore prevention must be factored into all work activities through developing an integrated policy and strategies for managing psychosocial stressors. Develop the plan in consultation with workers.

Primary sources of stress at work to consider in the plan are:

- demand (work load/work pattern/work environment)
- control (how much say the person has in the way they do their work)
- support (this includes the encouragement, sponsorship and resources provided by the organisation, line management and colleagues)
- relationships – bullying/violence/harassment (this includes promoting positive working to avoid conflict and dealing with unacceptable behaviour)
- role (whether people understand their role within the organisation and whether the organisation ensures that they do not have conflicting roles)
- change (how organisational change (large or small) is managed and communicated in the organisation).

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	Substituting	
	Isolating/preventing contact or exposure to risk	
	Imposing engineering control measures	
	Imposing administrative control measures	– Strong policies, reflected in all employment contracts to enable workers to manage stress. – Training for workers on managing psychosocial hazards. – Strong policies in all employment contracts to manage shift design and work hours. – Open communication with workers regarding autonomy in their work.
	Using personal protective equipment (PPE)	

The plan is to set out:

- the operator's policies on stress, bullying and violence
- how to report instances of stress, bullying and violence
- the steps the operator will take to address stress, bullying and violence
- the problem resolution process included in workers' employment agreements.

The plan needs to outline the process for investigating and resolving complaints of bullying.

Where can you find further information?

For further information see:

- WorkSafe's Preventing and Responding to Bullying at Work.

Drugs and alcohol

Drugs and alcohol use can result in impairment, where a worker is unfit for work. MOQO Regulation 108 (2)(a) requires that strategies are developed to deal with consumption of drugs and alcohol. These strategies must be proportionate to the hazards at the mining operation and to how a worker's behaviour could affect their or others' safety.

Describe the hazard

Workers impaired by drugs and alcohol are a health and safety risk to themselves, others, and workplace assets.

Plan

HOW CAN YOU ASSESS THE RISK?

Establish a drug and alcohol plan, including strategies to deal with drugs and alcohol, in consultation with workers and their representatives (where reasonably practicable).

The plan (strategy) is to specify that if workers are impaired, or may become impaired, by a prescription drug they are to inform the extractives operator. Workers may perform work while taking prescription medication if a medical practitioner has cleared them to do so.

The drug and alcohol plan needs to contain, at least:

- the tasks that are not to be performed under the influence of drugs or alcohol (high risk work)
- the position on the consumption of alcohol on site
- that workers are not to be under the influence of illegal drugs
- when drug/alcohol tests may be performed. This might include:
  - random testing
  - post incident testing
  - reasonable cause testing.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	Substituting	
	Isolating/preventing contact or exposure to risk	
	Imposing engineering control measures	
	Imposing administrative control measures	– Strong policies, reflected in all employment contracts. – Training.
	Using personal protective equipment (PPE)	

Where can you find further information?

For further information see:

- AS/NZS 4308 Procedures for specimen collection and the detection and quantitation of drugs of abuse in urine.

Non-ionising radiation

Describe the hazard

Non ionising radiation includes ultra-violet radiation and infra-red radiation.

Exposure to ultra-violet radiation is most commonly by exposure to the sun. Exposure can also occur during welding or plasma cutting. Exposure can cause sunburn and lead to skin cancer in later life, and damage the eye. All skin types can become sunburnt.

Sources of infra-red radiation include furnaces, molten metals and welding. Infra-red radiation can damage the eyes and skin.

Plan

HOW CAN YOU ASSESS THE RISK?

Mining and quarrying are not necessarily at a greater risk of non-ionising radiation than other industries. However, the risk is clear, even if harm cannot be predicted. Prevention must be factored into all work activities.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	Substituting	
	Isolating/preventing contact or exposure to risk	Welding barriers/screens
	Imposing engineering control measures	
	Imposing administrative control measures	– Work is conducted in shade. – Uncovered outside work is conducted outside of 10 am to 4 pm, wherever practicable.
	Using personal protective equipment (PPE)	– Long-sleeved clothing, sunglasses and sunhat. – Sunscreen. – Appropriate eye protection when welding, cutting, or working with molten metals.

Where can you find further information?

For further information see:

- WorkSafe's *Guidance notes for the protection of workers from solar UV radiation*
- AS/NZS 1338 *Filters for eye protectors series*
- Safe Work Australia's *Guide on Exposure to Solar Ultraviolet Radiation (UVR)*
- New Zealand Cancer Society website
- WorkSafe's *Health and Safety in Welding* good practice guideline.

Ionising radiation

Describe the hazard

Ionising radiation sources in mines include:

- naturally occurring radioactive material (NORM) such as radon gas and its decay products
- artificial radiation sources such as radiation gauges used for analysing mineral content, measuring density and moisture content, which are encapsulated and called sealed sources.

Ionising radiation is extremely harmful, and can cause debilitating or fatal conditions including:

- cancer
- acute radiation syndrome
- chronic radiation syndrome
- radiation-induced thyroiditis.

Radon gas is odourless, tasteless, and colourless (invisible). It emits ionising radiation in the form of alpha particles. Alpha particles are a hazard when taken internally, by inhalation of radon gas, or inhalation or ingestion of dust containing alpha particle emitting substances.

Plan

HOW CAN YOU ASSESS THE RISK?

An initial assessment needs to be conducted to assess the risk of naturally occurring radioactive materials. This should include information derived from:

- core samples
- soil samples
- geological data from site sampling
- historical sources.

An assessment also needs to be carried out where:

- the rock type changes from the initial assessment
- an area that was not previously assessed is being developed
- conditions are encountered that are not addressed by the risk assessment.

Use short-term passive dosimeters when monitoring for radon. These are to be positioned at specific locations for set periods (usually one month). At the end of the set period, the dosimeter is to be sent to an independent testing facility for analysis.

If radon is detected, the SSE needs to ensure that arrangements are in place to monitor the levels of radon using short-term passive dosimeters or air sampling monitors.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	**Substituting**	
	Isolating/preventing contact or exposure to risk	– Sealing the area where radon is being generated. – If the radon is desorbed from water, contain the water in pipes, direct the water to returns, or prevent turbulence of the water until it can be contained in pipes. – Following requirements of the Radiation Safety Act 2016 in regards to sealed sources.
	Imposing engineering control measures	– Dilution of the gas by permanently increasing ventilation quantity. – Directing the ventilation in the area where radon is being generated to a return airway.
	Imposing administrative control measures	– Controlled area work procedures in compliance with the Radiation Safety Act 2016.
	Using personal protective equipment (PPE)	

WorkSafe has adopted a reference level for Rn^{222} of an annual average activity concentration of 1000 Bq/m^3. Where Rn^{222} levels exceed the reference level, the control guidance given in the Ventilation ACOP and in the IAEA Safety Standards should be applied.

Where can you find further information?

For further information see:

- Safe Work Australia's *Draft Code of Practice for Managing Naturally Occurring Radioactive Materials in Minin*g
- WorkSafe's *Ventilation in Underground Mines and Tunnels Approved Code of Practice*
- Radiation Safety Act 2016

- Radiation Protection Act 1965
- Radiation Protection Regulations 1982
- International Atomic Energy Agency safety standard *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards General Safety Requirements Part 3*.

Biological hazards

Biological hazards include bacteria, fungi, viruses, plant and animal particles. They can cause a range of adverse health effects including infectious disease, respiratory diseases and cancer. Less serious health effects can occur, resulting in sickness and sick leave and reduced productivity and morale.

Sources of biological hazards in mining in the extractives sector can include human waste, food and food waste, contaminated water, compost, animal urine and faeces, and water sources.

Legionella

Legionella is a bacterium than can exist in water and soil, and, if it is inhaled, can cause fever and severe respiratory infection.

Potential water sources at risk of supporting the presence of Legionella bacteria include:

- water used for spraying on to extracted material by fogging cannons or directional misting units
- water used for spraying on to product for wet suppression of dust at transfer or discharge points
- water used for spraying on to roads for wet suppression of dust using water bowsers or fixed sprays
- hoses to clean areas of hard standing around processing plant and site buildings
- water used for spraying from vehicle or wheel washers
- water used as part of the production process eg barrel washers, wet scrubbers, cooling of cutting blades on saws
- water curtains for dust control (eg for dimensional stone cutting and processing)
- emergency showers.

Plan

HOW CAN YOU ASSESS THE RISK?

Mining and quarrying are not necessarily at a greater risk of biological hazards than other industries. However, the high quantity of water used in many operations does present a risk of Legionella, leptospirosis, and other biological hazards.

The risk is clear, but incidents cannot be predicted. Therefore prevention must be factored into all operation and maintenance procedures.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		Unnecessary water sources or pooled water, dead legs in piping systems
Minimising	Substituting	
	Isolating/preventing contact or exposure to risk	Reduce misting
	Imposing engineering control measures	– Controlling water temperature below 20, or above 45°C. – Minimising build-up of nutrients such as scale, dirt, process solids, leaves, vermin, insects, soil. – Eliminating production of aerosols.
	Imposing administrative control measures	– Water, vermin, and waste management processes. – Training. – Water treatment with bactericides. – Preventing stagnation by eliminating dead pipes, and regularly flushing emergency showers. – Testing water temperature. – Testing water for bacteria, and specifically Legionella.
	Using personal protective equipment (PPE)	PPE

Managing other biological risks

When managing risks from other biological hazards:

- ensure waste does not accumulate and is suitably contained
- ensure vermin are controlled
- practice good personal hygiene (washing and drying hands, covering mouth when sneezing or coughing, cleaning cuts and scratches)
- practice good housekeeping (regularly clean washrooms, toilets, food preparation/storage areas and break rooms)
- prevent water accumulation in indoor areas, and remove or treat water damaged building materials
- wear suitable protective equipment if removing any materials or waste contaminated with bacteria or fungi.

Where can you find further information?

For more information see:

- Ministry of Health's website for advice on preventing communicable diseases
- NZS 3666 *Air-handling and water systems of buildings - Microbial control series*
- WorkSafe's *General Risk and Workplace Management – Part 1 interpretive guidelines*, section 2
- WorkSafe's Approved Code of Practice on *Air Quality in Extractives*.

Other hazards

MOQO Regulation 108 (1)(n) requires the Worker Health Plan to address any other hazards that may adversely affect the health of mine workers who work at the operation. Some hazards, like slips, trips, and falls, are common across many industries, but the extractives industry has some specific hazards that are not specifically mentioned in Regulation 108. Pressure injection injuries and harm from hazardous substances are discussed below. Any other health hazards should be addressed in your Worker Health Plan.

Pressure injection injuries

Describe the hazard

Pressure injection injuries are caused by the high pressure injection of fluid such as oil or hydraulic fluid under the skin. Their minor appearance belays how much damage has occurred; aside from the toxicity of the fluid injected, the forced injection of fluid can cause permanent nerve damage and gangrene, leading to loss of limb.

Plan

HOW CAN YOU ASSESS THE RISK?

Pressure injection injuries happen when checking for leaks in a pressurised system. The leak is only apparent due to the presence of fluid nearby, and the worker runs a hand along the line to find it. When they reach the pinhole fluid is injected as if from a needle.

The risk is clear, but incidents cannot be predicted. Therefore prevention must be factored into all operation and maintenance procedures.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	**Substituting**	
	Isolating/preventing contact or exposure to risk	– Design specification and procurement of plant eg enclosing hydraulic pipes so they are inaccessible to workers
	Imposing engineering control measures	Guarding
	Imposing administrative control measures	– Training. – Formal inspection and maintenance regimes for hydraulic systems. – Lockout/tag-out procedure.
	Using personal protective equipment (PPE)	– Safety glasses or goggles for eye protection. – Heavy gloves.

Most equipment does not need to be pressurised to find a leak. Lock out and de-energising should be part of the SOP for the equipment. If the system has to be pressurized to find a leak, stand well away from the line, and used a piece of cardboard or wood to locate the leak. Do not use your hand. Wear appropriate PPE.

The most crucial aspect of pressure injection injuries is that they are treated as a serious surgical emergency.

Where can you find further information?

For more information refer to:

- *High Pressure Injection Injuries* safequarry.com
- Queensland Department of Natural Resources and Mines *Risk management of high pressure fluids and gases*.

Hazardous substances

Hazardous substances cover a wide range of substances, with an equally wide range of effects. Hazardous substances used in the extractives industry include:

- explosives and detonators
- compressed gases
- cyanide
- lead
- mercury
- acids
- resins (eg polyurethane resins)
- paints and solvents
- petrol, diesel and liquefied petroleum gas (LPG).

Some substances that can be hazardous to health are covered under the Hazardous Substances and New Organisms Act 1996 (HSNO). Management of these substances must meet the controls detailed in HSNO, and, from December 2017, those prescribed in the forthcoming Health and Safety at Work (Hazardous Substances) Regulations 2017 (HSWA HS Regulations).

Describe the hazard

Hazardous substances could be toxic (including hazardous to inhale, carcinogenic or affecting reproductive health), corrosive, or highly flammable or explosive. Some substances can affect the skin when in contact, or can be absorbed into the body via the skin. Work-related skin diseases are common and can occur in several forms including irritant dermatitis, allergic dermatitis, skin infection and skin injuries.

Plan

HOW CAN YOU ASSESS THE RISK?

Every extractive site should have a hazardous substances register together with the quantities and the type of storage vessel. Once this is established, the required controls are to be put in place. The HSWA HS Regulations will require sites to have an inventory when they come into effect.

A person in charge at all workplaces must manage hazardous substances. They must make sure that the mining operation complies with all requirements. Duties to maintain a safe and healthy workplace continue to apply to other duty holders.

Make sure that potential skin contaminants are considered in the risk assessment. The controls needed depend on the:

- substances used
- properties of the substances
- working methods
- exposure time
- availability of PPE.

Absorption of substances through the skin may result in a higher uptake than would have been expected from inhalation only. This is particularly important in absorption of vapour, as there may be no obvious contact between the skin and the substance. Biological monitoring of workers for exposure may be a useful supplement to monitoring levels in the air in these situations.

WHAT CONTROL MEASURES COULD YOU CONSIDER?

ACTION		EXAMPLE OF CONTROL MEASURE
Eliminating		
Minimising	Substituting	Use alternative and less harmful chemicals
	Isolating/preventing contact or exposure to risk	Keeping substances locked down
	Imposing engineering control measures	Appropriate storage and containment
	Imposing administrative control measures	Training
	Using personal protective equipment (PPE)	PPE

Many chemicals and fuels used in extractive operations are hazardous. The steps used to control exposure to hazardous substances are detailed in the relevant SDS for the substance.

Apply the manufacturer's instructions, as well as the relevant controls to skin contaminants.

Where significant uptake occurs via the skin, respiratory protection will give a false sense of security.

Where can you find further information?

For more information refer to:

- WorkSafe's Approved Code of Practice on *Air Quality in Extractives*
- Hazardous Substances Toolbox provides information on hazardous substances, controls and the HSNO calculator
- the Environmental Protection Authority's website contains information about hazardous substance approvals
- WorkSafe's *Workplace Exposure Standards and Biological Exposure Indices*
- product labels
- Safety Data Sheets.

Appendix A: Glossary

TERM	DEFINITION
Competent person	A person who has the knowledge, relevant experience and skill to carry out a particular task. Skills and knowledge may be acquired through training, qualification, or experience, or a combination of these.
Controls	An action taken that eliminates, isolates, or minimises the hazard.
Extractives operation	A mining operation, alluvial mining operation and quarrying operation. Extractives operator has a corresponding meaning.
Duty holder	A PCBU; SSE; a mine, alluvial mine, or quarry operator; or other safety critical role, as appropriate.
Health and safety representative (HSR)	A health and safety representative (HSR) is a worker elected by the members of their work group to represent them in health and safety matters, in accordance with subpart 2 of Part 3 of HSWA.
Health hazard	A potential source of harm that could have an adverse health effect on a person.
Mining operation	As per HSWA has the meaning given in HSWA, Schedule 3, Part 1, Clause 2.
Mine operator	As per HSWA has the meaning given in HSWA, Schedule 3, Part 1, Clause 1.
Persons conducting a business or undertaking (PCBUs)	A PCBU is a 'person conducting a business or undertaking'. A PCBU may be an individual person or an organisation. This does not include workers or officers of PCBUs (to the extent they are solely workers or officers), volunteer associations (that do not have employees), or home occupiers that employ or engage a tradesperson to carry out residential work. A PCBU must ensure, so far as is reasonably practicable, the health and safety of workers, and that other persons are not put at risk by its work. See WorkSafe's website: www.worksafe.govt.nz for information about PCBU duties.
Principal control plan (PCP)	A plan required under MOQO Regulation 92. The plan documents systems and processes in place at the mining or tunnelling operation to manage hazards at the operation, and the measures that are necessary to manage principal hazards at the mining or tunnelling operation. See MOQO Regulation 93.
Principal hazard	Any hazard arising at any mining operation (including a tunnelling operation) that could create a risk of multiple fatalities in a single accident or a series of recurring accidents at the mining operation in relation to any of the following: 1. ground or strata instability: 2. inundation and inrush of any substance: 3. mine shafts and winding systems: 4. roads and other vehicle operating areas: 5. tips, ponds, and voids: 6. air quality: 7. fire or explosion: 8. explosives: 9. gas outbursts: 10. spontaneous combustion in underground coal mining operations. It also includes any other hazard at the mining operation (including a tunnelling operation) that has been identified by the site senior executive under MOQO Regulation 66 as a hazard that could create a risk of multiple fatalities in a single accident, or a series of recurring accidents at the mining operation. See MOQO Regulation 65.
Principal hazard management plan (PHMP)	A plan required under MOQO Regulation 66. The PHMP describes a principal hazard and sets out the controls used to manage it. A PHMP must be prepared for each principal hazard identified at the mining or tunnelling operation. MOQO Regulations 68, 69 and 70 cover what needs to be included in a PHMP, and requirements for reviews, revisions and audits. MOQO
Risk	The likelihood and consequence of harm occurring.

TERM	DEFINITION
Workers	A worker is an individual who carries out work in any capacity for a PCBU. A worker may be an employee, a contractor or sub-contractor, an employee of a contractor or sub-contractor, an employee of a labour hire company, an outworker (including a homeworker), an apprentice or a trainee, a person gaining work experience or on a work trial, or a volunteer worker. It also includes an individual PCBU that carries out work for the business or undertaking. Workers can be at any level (eg managers are workers too). Workers have duties to take reasonable care to keep themselves and others healthy and safe when carrying out work. Workers must co-operate with reasonable policies and procedures that the PCBU has in place that have been notified to them. Workers must comply, so far as is reasonably practicable, with any reasonable instruction given by the PCBU so the PCBU can comply with the law.
Other persons at workplaces such as visitors	Examples of other persons at workplaces include workplace visitors, casual volunteers at workplaces and customers. Other persons have duties to take reasonable care for their own health and safety and to take reasonable care that they don't harm others at a workplace. They must comply, so far as is reasonably practicable, with any reasonable instruction about health hazards given by the PCBU so the PCBU can comply with the law. Other persons should report hazards they notice so the PCBU can do something about it.

Disclaimer

WorkSafe New Zealand has made every effort to ensure the information contained in this publication is reliable, but makes no guarantee of its completeness. WorkSafe may change the contents of this guide at any time without notice.

This document is a guideline only. It should not be used as a substitute for legislation or legal advice. WorkSafe is not responsible for the results of any action taken on the basis of information in this document, or for any errors or omissions.

ISBN: 978-1-98-852710-9 (online)

Published: August 2017 Current until: 2019

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WSNZ_2717_AUGUST 2017

ISBN 978-1-98-852710-9 (online)

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