

Title: Tool for Organisational Risk Evaluation for Occupational Health Stressors (OREOHS) for the small-scale mining industry.

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Abstract:

Some of the main reasons for occupational health and safety deficiencies in small-scale mining are unawareness of risks of chronic occupational diseases and inadequately implemented education and training (1,2). The key needs of the sector is to provide access to knowledge and tools that will raise awareness and disseminate affordable, best practice methods for use by small-scale mines (1).

With this in mind, the CSIR Occupational Health and Ergonomics research group have developed the OREOHS tool which is a comprehensive model for hazard identification and risk assessment of occupational health stressors that can be applied to mining operations of various types and sizes but in particular by small-scale enterprises. Flow-diagrams indicate the important factors and areas to be audited in the workplace and highlight the essential influencing factors for the main occupational health stressor encountered in the mining environment namely, occupational noise, respirable silica dust, thermal stress (both heat stress and cold stress) and ergonomic factors. The total organisational risk to the company and the overall health risk flow-diagram begins the process of risk evaluation for the main health stressors followed by an evaluation of the financial risks to the organisation from health stressors. Then two flow diagrams outline the areas that must be considered when implementing interventions in the workplace that will reduce the risk of occupational health risk and when evaluating the success of the interventions implemented. OREOHS also contains practical tools in the form of checklists for each occupational health stressor. These checklists were intended for use by mine practitioners with limited experience in identifying workplace hazards and assessing risks. A scoring system was included in the checklists to facilitate a quantifying of the risk which would further enable a risk rating and ranking of health hazards in the workplace. Guidelines for the use of the organisational evaluation of risks associated with exposure to health stressors and guidelines for the use of each checklist are included. The OREOHS can be transposed onto a spreadsheet that will facilitate the automatic calculation of the risk rating and ranking of health hazards in a small mine.

Key words: occupational health stressors, risk evaluation, small-mine industry

Introduction

Until recently, small- scale mines, which play a role in poverty alleviation by providing employment, were not catered for in South African mining policy. Approximately 20 000 small-scale miners are working in South Africa (3). Small scale miners often lack awareness of the legal requirements for mining and the means to address health risks.

Performance-based approaches in occupational health law do not meet the needs of companies that are small and underresourced, and that require explicit guidance on what is required of them. Greater appreciation of the circumstances of small-scale miners could support the development of appropriate Occupational Health and Safety (OHS) policy and intervention strategies (4).

The nature of small-scale mining which is mainly self-employment, low mechanisation and low productivity means that the use of procedures to prevent occupational diseases depends almost exclusively on the consciousness of the owner to the relevant issues (4).The main reasons for occupational health and safety deficiencies in small-scale mining are financial, discouragement about the non-applicability of regulations promulgated mainly for large-scale mining operations, unawareness of risks of chronic occupational diseases and inadequately implemented education and training (1,2).

Research on the extent of small scale mining in the southern African region shows the exponential development in the industry and Dreschler et al (2001) recommend that building the capacity of small-scale mine managers to improve occupational health management must be a priority for intervention. Their research indicated that the key needs of the sector to enable it to make meaningful contribution to sustainable development was, among others, to provide access to knowledge and tools that would raise awareness and disseminate affordable, best practice methods for use by small-scale mines (1).

Tool for Organisational Risk Evaluation for Occupational Health Stressors (OREOHS)

With the above caveat in mind, the CSIR Optimal Miner research team used specialist focus group discussions and workshops to brain storm the development of a comprehensive model for hazard identification and risk assessment of occupational health stressors, that can be applied to mining operations of various types and sizes but in particular by small-scale enterprises.

Flow-diagrams indicate, in a practicable way, the important factors and areas to be audited in the workplace. The flow-diagrams highlight the essential influencing factors for the main occupational health stressor encountered in the mining environment namely, occupational noise, respirable silica dust, thermal stress (both heat stress and cold stress) and ergonomic factors.

The model firstly uses as a background the total organisational risk to the company and the overall health risk flow-diagram begins the process of risk evaluation for the main health stressors likely to be encountered. The flow-diagram for each main health risk follows. The next step in the model is to evaluate the financial risks that impact on the health of the workers and on the productivity and financial success of the mine. All factors that must be taken into account are depicted on the flow-diagram.

The prevention of occupational disease and injury must always be a priority for a mine that adheres to the constitutional rights of workers. The next two flow-diagrams therefore outline the areas that must be considered when implementing interventions in the workplace that will reduce the risk of occupational health risk and when evaluating the success of the interventions implemented.

Based on the model depicted in the flow-diagrams the team then developed practical tools in the form of checklists for each occupational health stressor. These checklists were intended for use by mine practitioners with limited experience in identifying workplace hazards and assessing risks. A scoring system was included in the checklists to facilitate a quantifying of the risk which would further enable a risk rating and ranking of health hazards in the workplace.

Guidelines for the use of the organisational evaluation of risks associated with exposure to health stressors and guidelines for the use of each checklist were drawn up. The OREOHS can be transposed onto a spreadsheet that will facilitate the automatic calculation of the risk rating and ranking of health hazards in a small mine.

Models

Total organizational risk

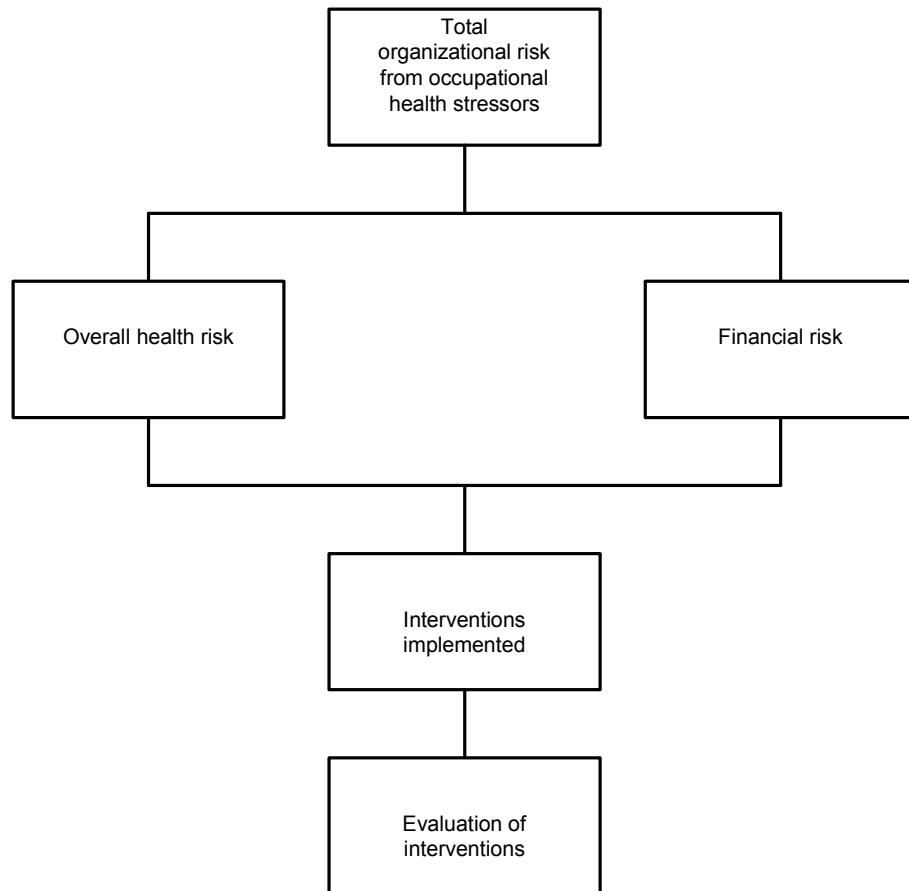


Figure 1. Total organizational risk from occupational health stressors flow-diagram

Overall Health risk

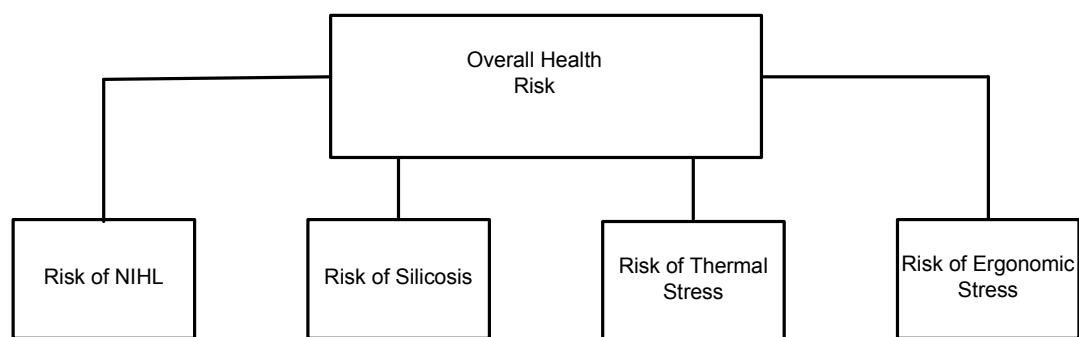


Figure 2 Overall health risk evaluation flow-diagram

Risk of noise-induce hearing loss (NIHL)

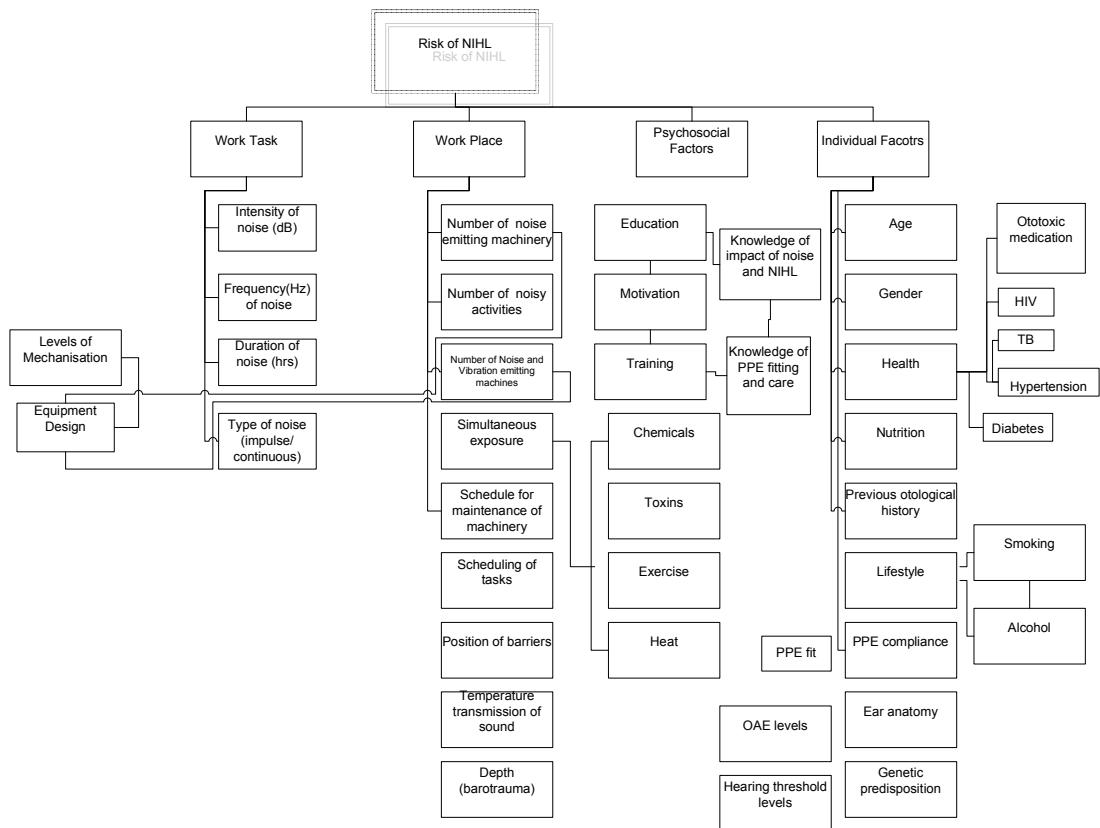


Figure 3 Risk of noise induced hearing loss flow-diagram

Risk of silicosis

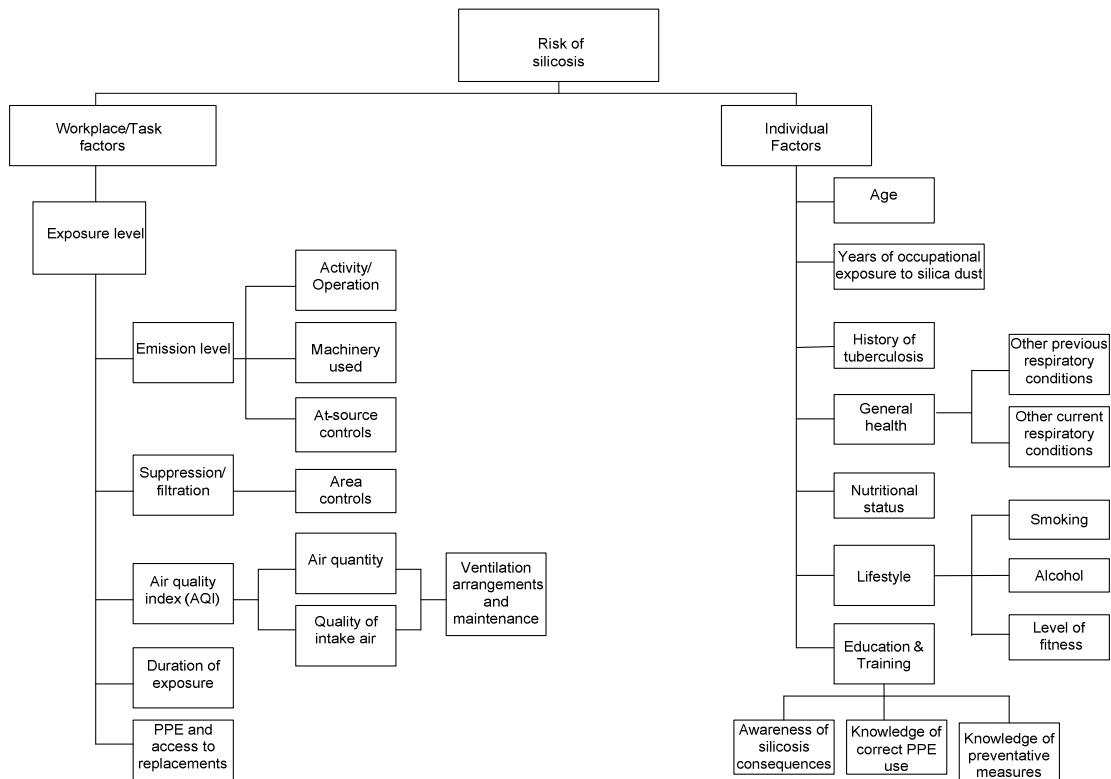


Figure 4 Risk of silicosis flow-diagram

Risk of heat stress

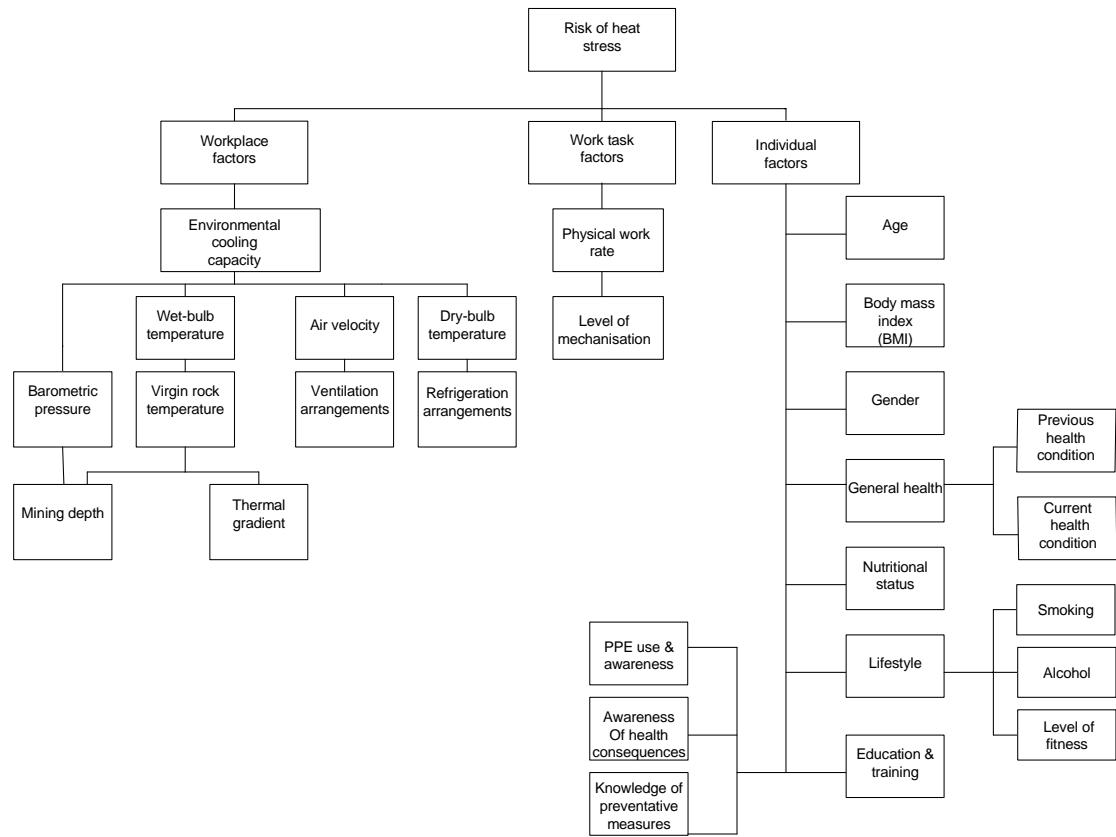


Figure 5 Risk of heat stress flow-diagram

Risk of cold stress

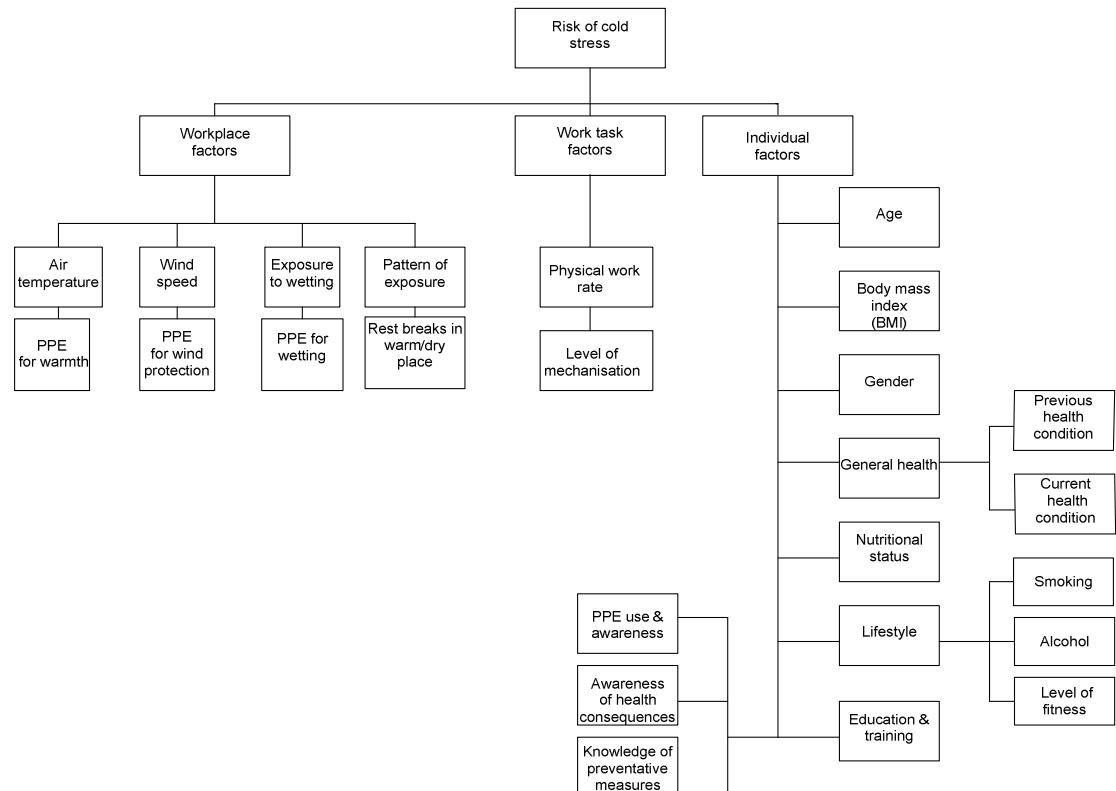


Figure 6 Risk of cold stress flow-diagram

Risk of Ergonomic stress

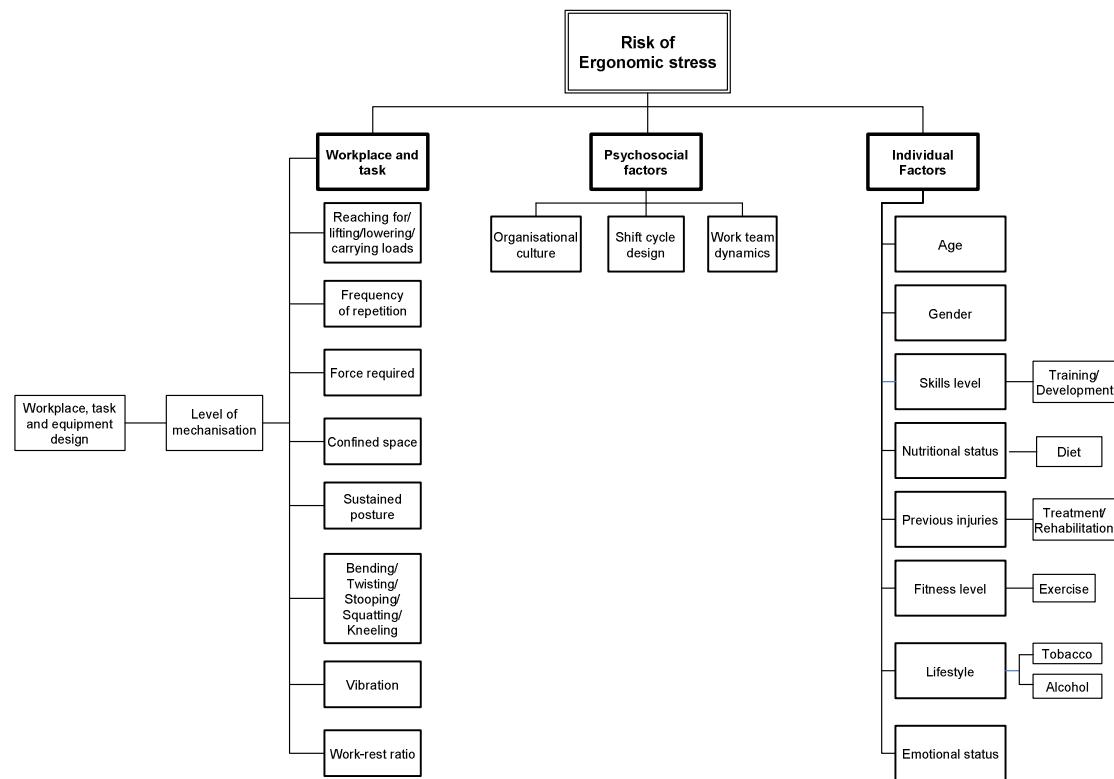


Figure 7 Risk of ergonomic stress flow-diagram

Financial risk evaluation

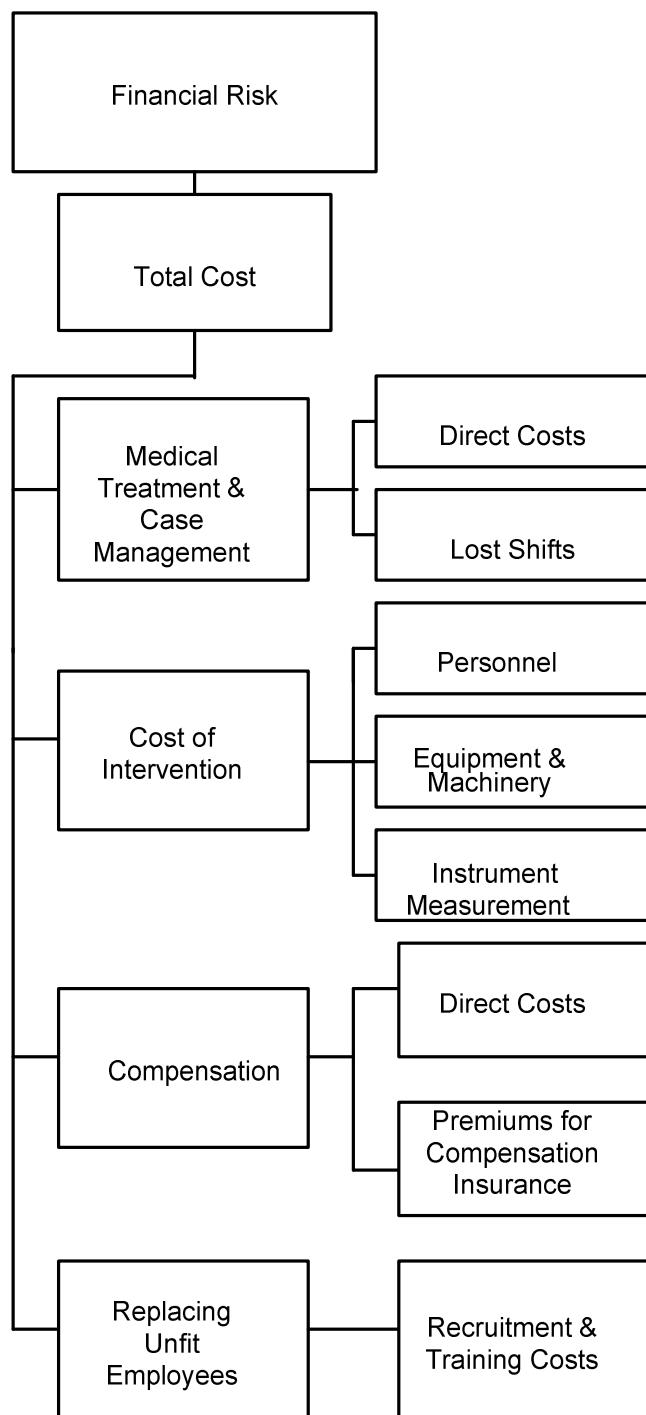


Figure 8 Financial risk evaluation flow-diagram

Interventions implemented

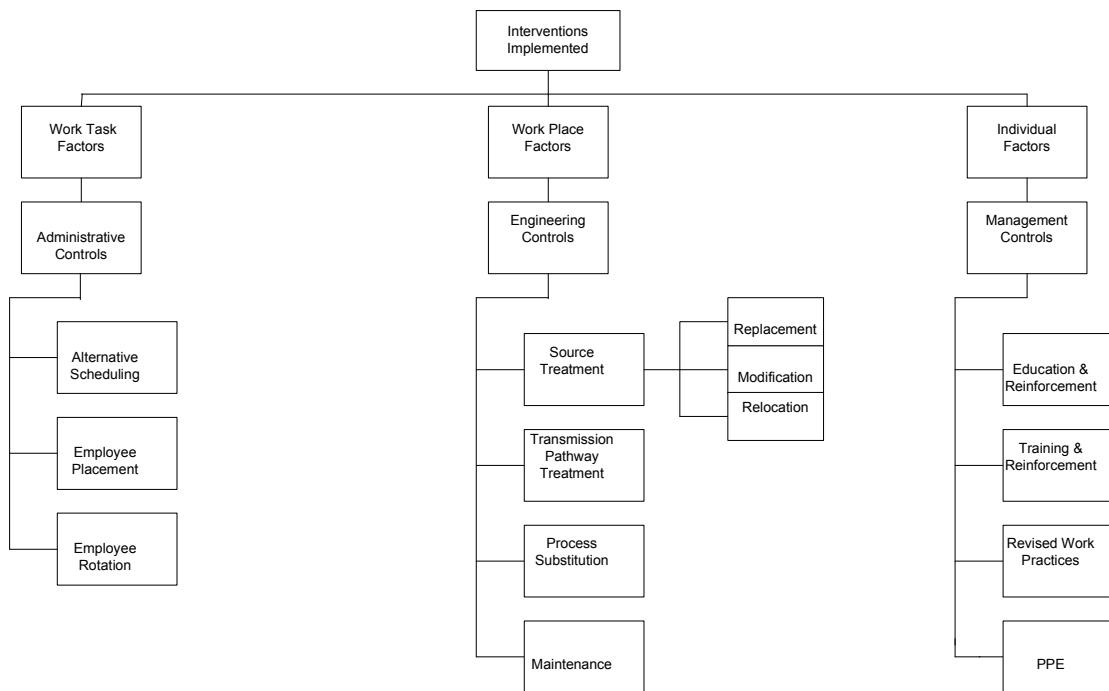


Figure 9 Interventions implemented flow-diagram

Evaluation of Interventions Implemented

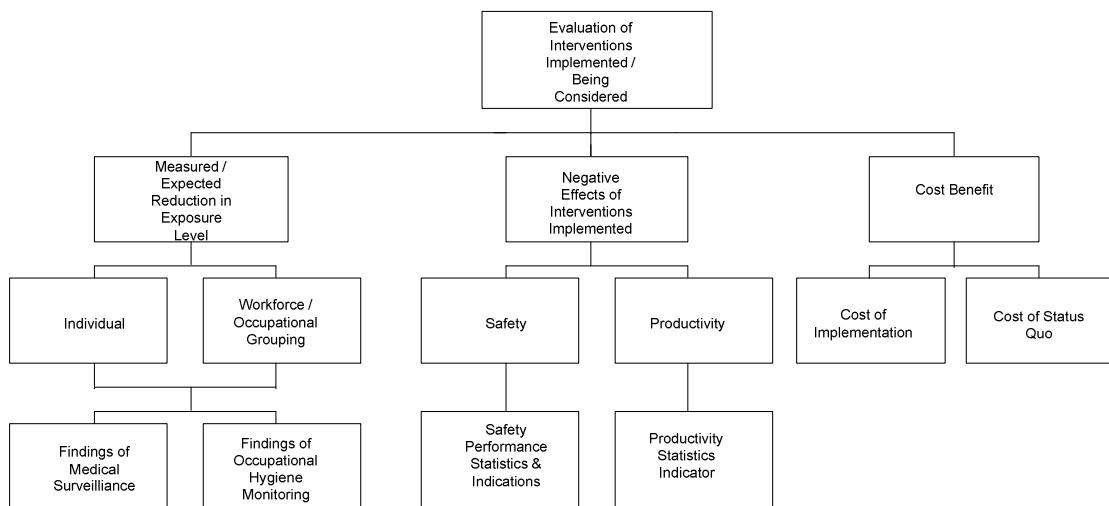


Figure 10 Evaluation of interventions implemented flow-diagram

Checklists and guidelines for tools to identify and rate the potential impacts of occupational health stressors

The subsections that follow relate to the tools or checklists developed to assist practitioners in identifying and rating risks posed by health stressors that are common in mining. The stressors considered are heat, cold, unfavourable ergonomics, noise and respirable silica dust.

Section 1 of each checklist considers the workplace or, where various tasks are performed, individual tasks. Although the presence or absence of some risk factors would be common to many or even all tasks in a given workplace, any differences between them would indicate the need to complete a separate checklist for each.

Depending on the presence or absence of each factor for the stressor being considered, the Hygienist marks the applicable response, i.e. “**No risk**” or “**Potential risk**” and enters the applicable risk value (0 or 1, respectively). Ideally, this should be done during on-site workplace and task evaluations, using a hardcopy of the worksheet or a personal digital assistant (PDA). As the findings are later entered or uploaded into the worksheet on computer, risk values are automatically summed for the workplace or task in question.

Section 2 of the checklist considers individual employee factors, evaluated by the Occupational Health or Occupational Medical Practitioner. As for workplace or task, responses and risk values are entered into the worksheet and a total is calculated for the employee in question. The worksheet combines the workplace/task and individual employee sums and displays the risk value for that person in that workplace/task.

All checklists for a given stressor are linked to a summary worksheet, which automatically calculates the total number of employees involved in a given type of workplace/task and mean risk values for each factor considered. The worksheet then sums the means for all workplaces/tasks of that type and employees affected.

NIHL risk

The checklist for evaluating noise-induced hearing loss (NIHL) risks is shown in Table 1. It takes account of 14 workplace- or task-related risk factors that include the nature of the noise being emitted, viz. the level (in decibels), pattern of emission (continuous or intermittent), presence/absence of impulse noise (from hammering, punching, stamping, or blasting) and reverberation or echoing (as in a confined space). Due to the oto-toxic nature of some organic solvents, the checklist also includes exposure to such agents as a risk factor.

Provision is made for risk management interventions such as engineering controls to limit, contain or exclude noise emission, administrative controls to limit individual employee exposure and receptor controls in the form of hearing protection devices (HPD) for noise-exposed employees. Given that any personal protection strategy is reliant on the compliance of individual employees, the checklist provides for any limitations that may exist in employee education, training and reinforcement training with regard to the consequences of NIHL and means of limiting NIHL risks, which include the correct use of HPDs. For instances where an employee is found to have a developing case of NIHL, the checklist considers whether effective counselling is provided to encourage compliance with risk control measures.

After recording the number of employees involved in the workplace or task being assessed, the Hygienist enters the applicable response ("No risk" or "Potential risk") and risk value (0 or 1) for each of the 14 workplace- or task-related risk factors. As values are entered the total risk value for the workplace or task is displayed in 1.15.

Employee-related risk factors should be evaluated by the Occupational Health or Medical Practitioner. These include age, general health, nutritional status, fitness, use of alcohol and tobacco, history of ear complaints, treatment for tuberculosis and deterioration of hearing from the Baseline audiogram. As the practitioner enters the applicable response and risk value, the score for the employee is displayed in 2.13 and combined with the value from 1.15. The resulting total for the employee's risk of NIHL in the workplace or task being considered is displayed in 3. Risk is classified as "Insignificant" (0 to 8), "Moderate" (9 to 17) or "Significant" (18 to 26).

Silicosis risk

Risk factors relevant to the development of silicosis are evaluated using the checklist in Table 2. It considers the presence of silica quartz in the ore body being mined, the concentration of respirable silica dust in relation to the occupational exposure limit (OEL) and the daily period of exposure.

The checklist also includes risk management interventions such as engineering controls to limit the generation and dispersion of silica dust, and receptor controls in the form of PPE. Due to the fact that individual employee compliance with the use of PPE is essential for an effective personal protection strategy, consideration is given education and training for dust-exposed employees with regard to the consequences of silicosis and measures to limit the risk of contracting silicosis. The checklist also includes the training provided for employees who maintain dust-generating machinery and the associated engineering controls.

The preceding workplace- or task-related risk factors should be evaluated by the Hygienist, who firstly enters the number of affected employees. As the applicable response (“No risk” or “Potential risk”) and risk value (0 or 1) are entered in lines 1.1 to 1.9, the total score for the workplace or task being assessed is displayed in 1.10.

The nine employee-related risk factors, which should be evaluated by the Occupational Health or Medical Practitioner, include age, level of fitness nutritional status, general health and the use of tobacco. Also considered are the employee’s years of occupational exposure to silica dust, recent chest x-ray and lung function test results, and medical history with regard to tuberculosis. The employee’s score is displayed in 2.10 and combined with 1.10 to give the total risk value for that employee in the workplace or task being considered (3). Risk is classified either as “Insignificant” (0 to 5), “Moderate” (6 to 12) or “Significant” (13 to 18).

Heat stress risk

Risk factors for heat stress are evaluated using the checklist shown in Table 3. Section 1 is used by the Hygienist to evaluate 15 workplace- or task-related factors, which include wet- and dry-bulb temperature, physical work rate, level of mechanisation, access to drinking water and to emergency treatment facilities, use of PPE, as well as education and training.

The 10 employee-related factors are evaluated by the Occupational Health or Medical Practitioner. These include age, gender, BMI, fitness, general health, nutritional status, medical history with regard to heat disorders, use of tobacco and alcohol, as well as whether or not the employee has passed a heat tolerance screening test within the last 12 months.

After the Hygienist and Health/Medical Practitioner have entered the applicable values, the total risk for a given employee in the workplace or task being considered is given in Section 3 of the checklist. Risk values from 0 to 7 are classified as “Insignificant”, values from 8 to 17 as “Moderate” and those from 15 to 25 as “Significant”.

Cold stress risk

The checklist for cold stress is presented as Table 4 It considers environmental factors such as air temperature, wind, pattern of exposure and whether or not employees are subject to wetting. The checklist also considers the use of personal protective equipment (PPE) and other provisions to limit cold stress, including education and training, and emergency treatment facilities. Workplace/ task-related factors should be evaluated by the Hygienist.

After entering the number of affected employees, the Hygienist scores the risk factors for the workplace or task being assessed (1.1 to 1.13). The total score is displayed in 1.14.

Risk factors for individual employees should be evaluated by the Occupational Health or Medical Practitioner. These include age, gender, body mass index (BMI), fitness, general health, nutritional status, use of alcohol and tobacco, as well as previous instances of cold-related disorders or complaints. The total score for the employee in the workplace or task being considered is displayed in 2.10. This value is combined with that from 1.14 to yield a total risk value for a given employee in the workplace/ task being considered (3). Risk is classified either as “Insignificant” (0 to 6), “Moderate” (7 to 15) or “Significant” (16 to 22).

Ergonomic stress risk

The checklist for evaluating ergonomic stress factors is shown in Table 5. It considers several posture- and musculoskeletal-related factors such as lifting, lowering and carrying of loads, reaching, twisting, bending, stooping, kneeling and squatting. It also makes provision for repetitive tasks and continuous muscle exertion, hand-arm and whole body vibration and, where relevant, the use of PPE. For mobile equipment, the checklist considers operator seating position with regard to multi-plane adjustment, back, lumbar and arm support, transmission of vibration to the operator, as well as the view of surrounding activities and roadways while travelling.

Workplace/task-related factors should be evaluated by the Hygienist, beginning with the number of affected employees. Next, the applicable response (“No risk” or “Potential risk”) and the corresponding risk value (0 or 1) for each risk factor being evaluated is entered in lines 1.1 to 1.23. As risk values are entered, the total score for the workplace or task is displayed in line 1.24.

Risk factors for individual employees should be evaluated by the Occupational Health or Medical Practitioner. These include age, gender, body mass index (BMI), fitness, nutritional status, general health, use of alcohol and tobacco, as well as previous instances of injuries or complaints involving the neck, back, shoulder, elbow, wrist and fingers. As the practitioner enters the applicable response and risk value for each of the 10 factors, the score for the employee in the workplace or task being considered is displayed in 2.11. This value is combined with that for the workplace/task (1.24), to yield a total risk value for the employee in the workplace or task being considered (3). Risk is classified either as “Insignificant” (0 to 10), “Moderate” (11 to 22) or “Significant” (23 to 33).

Conclusion

The social cost and burden of failing to address the question of worker health is and will continue to be unbearable for the developing economy of South Africa (2). The OREOHS tools will assist in providing knowledge that is the “what to do” and the skill that is the “how to do it” that the presidential audit report identifies as the important drivers of good health and safety performance, productivity and sector growth (2). OREOHS is a useful tool that embraces the values of the Mine Health and Safety Act that calls for protection of the health and safety of persons at mines as well as requires employers and employees to identify hazards and eliminate, control and minimise the risks relating to health and safety at mines (5).

Table 1 Identification and assessment of NIHL risk factors

Mark (X) each item in the appropriate column (No risk or Potential risk) and enter the value (0 or 1) in the last column (under Risk value). Enter the total score for Workplace/Task (1.15), Individual employee (2.13) and for the Individual employee in the Workplace/Task being considered (3).			Contribution to NIHL risks in (Name of workplace or task)		
Number of employees in this workplace or performing this task			No risk (Score = 0)	Potential risk (Score = 1)	Risk value (0 or 1)
1 NIHL risk factors for this workplace or task, as determined by Hygienist					
1.1 Noise level exceeds 85 dBA			No	Yes	
1.2 Pattern of noise emission is continuous			No	Yes	
1.3 Emissions include noise, e.g. hammer blows, punching, stamping, blasting			No	Yes	
1.4 Reverberation of noise occurs			No	Yes	
1.5 Exposure to organic solvents			No	Yes	
1.6 Significant sources of noise have been scheduled for engineering controls			Yes	No	
1.7 Effective administrative controls implemented to limit individual employee exposure			Yes	No	
1.8 Use of HPDs is effectively enforced			Yes	No	
1.9 Limitations on access to replacement HPDs			No	Yes	
1.10 HPD selection provides for individual needs, i.e. workplace noise and any existing hearing loss			Yes	No	
1.11 Limitations on employee training in the use of HPDs			No	Yes	
1.12 Limitations on employee education regarding the impact of NIHL			No	Yes	
1.13 Limitations on reinforcement training in limiting NIHL risks			No	Yes	
1.14 Limitations on counselling for employees with developing hearing loss			No	Yes	
1.15 Total for workplace/task:					0
2 NIHL risk factors for individual employee, as determined by Occupational Health or Occupational Medical Practitioner					
2.1 Age 50 years or less			Yes	No	
2.2 Reasonable level of fitness			Yes	No	
2.3 Reasonable nutritional status			Yes	No	
2.4 General health good			Yes	No	
2.5 History of ear problems, e.g. otitis media, tympanic perforation			No	Yes	
2.6 Current or previous treatment for tuberculosis			No	Yes	
2.7 Tobacco use			No	Yes	
2.8 Alcohol use			No	Yes	
2.9 Found to be non-compliant with regard to use of HPDs in noisy areas			No	Yes	
2.10 PLH shift from Baseline exceeding 2 %			No	Yes	
2.11 PLH shift from Baseline exceeding 5 %			No	Yes	
2.12 PLH shift from Baseline exceeding 7 %			No	Yes	
2.13 Total for individual employee					0
3 Total for individual employee in this workplace/task (1.15 + 2.13)					0
RISK CLASSIFICATION					
Workplace or Task: 0 to 4 Insignificant; 5 to 9 Moderate; 10 to 14 Significant					
Individual employee: 0 to 3 Insignificant; 4 to 8 Moderate; 9 to 12 Significant					
Individual employee in this workplace or performing this task: 0 to 8 Insignificant; 9 to 17 Moderate; 18 to 26 Significant					

Table 2. Identification and assessment of silicosis risk factors

Mark (X) each item in the appropriate column (No risk or Potential risk) and enter the value (0 or 1) in the last column (under Risk value). Enter the total score for Workplace/Task (1.10), Individual employee (2.10) and for the employee in this workplace or performing this task (3).			Contribution to risk of silicosis in (Name of workplace or task)		
Number of employees in this workplace or performing this task			No risk (Score = 0)	Potential risk (Score = 1)	Risk value (0 or 1)
1 Silicosis risk factors for workplace or task, as determined by Hygienist					
1.1	Silica quartz occurs in the ore body being mined		No	Yes	
1.2	Silica quartz concentration equals or exceeds 50% of the OEL		No	Yes	
1.3	Engineering controls for dust-generating machinery and operations are effective and reliable		Yes	No	
1.4	Engineering personnel properly trained in the maintenance of engineering controls		Yes	No	
1.5	PPE issued for silica dust		Yes	No	
1.6	Limitations on availability of replacement PPE		No	Yes	
1.7	Duration of exposure		8 h or less	More than 8 h	
1.8	Limitations on the education and training regarding the consequences of silicosis		No	Yes	
1.9	Limitations on the education and training regarding measures to limit the risk of silicosis		No	Yes	
1.10	Total for workplace/work task:				0
2 Silicosis risk factors for individual employee, as determined by Occupational Health or Occupational Medical Practitioner					
2.1	Age 50 years or less		Yes	No	
2.2	Level of fitness		Fit	Unfit	
2.3	Nutritional status		Good	Fair or Poor	
2.4	General health		Good	Fair	
2.5	10 or more years of occupational exposure to silica quartz		No	Yes	
2.6	Active or previous case of tuberculosis		No	Yes	
2.7	Chest x-rays found to be normal within last 12 months		Yes	No	
2.8	Lung function found to be normal within last 12 months		Yes	No	
2.9	Use of tobacco		No	Yes	
2.10	Total for individual employee:				0
3	Total for individual employee in this workplace or performing this task (1.10 + 2.10):				0
RISK CLASSIFICATION					
Workplace or work task: 0 to 2 Insignificant; 3 to 6 Moderate; 7 to 9 Significant					
Individual employee: 0 to 2 Insignificant; 3 to 6 Moderate; 7 to 9 Significant					
Individual in this workplace or this performing task: 0 to 5 Insignificant; 6 to 12 Moderate; 13 to 18 Significant					

Table 3 Identification and assessment of heat stress risk factors

Mark (X) each item in the appropriate column (No risk or Potential risk) and enter the value (0 or 1) in the last column (under Risk value). Enter the total score for Workplace/Task (1.17), Individual employee (2.11) and for the Individual employee in the Workplace/Task being considered (3).			Contribution to risk of heat stress in (Name of workplace or task)		
			No risk (Score = 0)	Potential risk (Score = 1)	Risk value (0 or 1)
Number of employees in this workplace or performing this task					
1 Heat stress factors for this workplace or task, as determined by Hygienist					
1.1	Physical work rate		Low	Moderate/Strenuous	
1.2	Limitations on rest breaks and self-pacing		No	Yes	
1.3	Level of mechanisation adequate		Yes	No	
1.4	Wet-bulb temperature 27,4°C or below		Yes	No	
1.5	Dry-bulb temperature 37,0°C or below		Yes	No	
1.6	Exposure to solar radiation		No	Yes	
1.7	Effective PPE issued for solar radiation		Yes	No	
1.8	Exposure to radiant heat		No	Yes	
1.9	Effective PPE issued for radiant heat		Yes	No	
1.10	Exposure to heat emitted by machinery		No	Yes	
1.11	Duration of exposure exceeds 8 h		No	Yes	
1.12	Limitations on availability of drinking water		No	Yes	
1.13	Limitations on access to emergency evacuation and treatment facilities		No	Yes	
1.14	Limited education and training in the prevention of heat disorders and heat stress		No	Yes	
1.15	Limited education and training in the recognition and treatment of heat disorders		No	Yes	
1.16	Total for workplace/task:				0
2 Heat stress factors for individual employee, as determined by Occupational Health or Occupational Medical Practitioner					
2.1	Age 50 years or less		Yes	No	
2.2	Gender (Male = 0; Female = 1)		Male	Female	
2.3	Body mass index 20 to 35		Yes	No	
2.4	Reasonable level of fitness		Yes	No	
2.5	Reasonable nutritional status		Yes	No	
2.6	General health good		Yes	No	
2.7	Found to be potentially heat tolerant by heat tolerance screening (HTS) within last 12 months		Yes	No	
2.8	Previous instances of heat disorders/complaints, e.g. dizziness, heat collapse, heat exhaustion		No	Yes	
2.9	Use of tobacco		No	Yes	
2.10	Use of alcohol		No	Yes	
2.11	Total for individual employee:				0
3	Total for individual employee in this workplace/task (1.16 + 2.11):				0
RISK CLASSIFICATION					
Workplace or Task: 0 to 4 Insignificant; 5 to 10 Moderate; 11 to 15 Significant					
Individual employee: 0 to 2 Insignificant; 3 to 7 Moderate; 8 to 10 Significant					
Individual employee in this workplace or performing this task: 0 to 7 Insignificant; 8 to 17 Moderate; 18 to 25 Significant					

Table 4 Identification and assessment of cold stress risk factors

Mark (X) each item in the appropriate column (No risk or Potential risk) and enter the value (0 or 1) in the last column (under Risk value). Enter the total score for Workplace/Task (1.14), Individual employee (2.10) and for the Individual employee in the workplace/task being considered (3).			Contribution to risk of cold stress in _____ (Name of workplace or task)		
Number of employees in this workplace or performing this task			No risk (Score = 0)	Potential risk (Score = 1)	Risk value (0 or 1)
1 Cold stress factors for this workplace or task, as determined by Hygienist					
1.1 Equivalent chill temperature (considering the effect of wind) below 10°C			No	Yes	
1.2 Pattern of exposure continuous during the work shift			No	Yes	
1.3 Duration of exposure exceeds 8 h			No	Yes	
1.4 Effective PPE issued for cold protection			Yes	No	
1.5 Exposure to wind			No	Yes	
1.6 Effective PPE issued for wind protection			Yes	No	
1.7 Exposure to water/wetting			No	Yes	
1.8 Effective PPE issued for protection against water/wetting			Yes	No	
1.9 Physical work rate			Moderate/Strenuous	Low	
1.10 Mobile equipment provides heating for operator cabin			Yes	No	
1.11 Limitations on education and training with regard to limiting cold stress			No	Yes	
1.12 Limitations on education and training in recognition and treatment of frostbite and hypothermia			No	Yes	
1.13 Limited emergency evacuation and treatment facilities			No	Yes	
1.14 Total for workplace/task:					0
2 Cold stress factors for individual employee, as determined by Occupational Health or Occupational Medical Practitioner					
2.1 Age 50 years or less			Yes	No	
2.2 Gender (Male = 0; Female = 1)			Male	Female	
2.3 Body mass index 20 or above			Yes	No	
2.4 Reasonable level of fitness			Yes	No	
2.5 Reasonable nutritional status			Yes	No	
2.6 General health good			Yes	No	
2.7 Previous instances of cold disorders/complaints, e.g. frostbite, chills, hypothermia			No	Yes	
2.8 Use of tobacco			No	Yes	
2.9 Use of alcohol			No	Yes	
2.10 Total for individual employee:					0
3 Total for individual employee in this workplace/task (1.14 + 2.10):					0
RISK CLASSIFICATION					
Workplace or Task: 0 to 3 Insignificant; 4 to 9 Moderate; 10 to 13 Significant					
Individual employee: 0 to 2 Insignificant; 3 to 6 Moderate; 7 to 9 Significant					
Individual employee in this workplace or task: 0 to 6 Insignificant; 7 to 15 Moderate; 16 to 22 Significant					

Table 5 Identification and assessment of ergonomic stress factors

Number of employees in this workplace or performing this task		Contribution to ergonomic risks in (Name of workplace or task)					
1 Ergonomic risk factors for this workplace or task, as determined by Hygienist		No risk (Score = 0)	Potential risk (Score = 1)	Risk value (0 or 1)			
1.1	Lifting or lowering of loads (tools, materials, equipment) weighing more than 25 kg	No	Yes				
1.2	Overhead reaching for loads (tools, materials, equipment) weighing more than 25 kg	No	Yes				
1.3	Bending or twisting at the waist while handling loads (tools, materials, equipment)	No	Yes				
1.4	Frequent bending, stooping or squatting	No	Yes				
1.5	Climbing steps or ladder while carrying loads (tools, materials, equipment)	No	Yes				
1.6	Walking while carrying loads	No	Yes				
1.7	Manual tasks repeated frequently	No	Yes				
1.8	Bending of neck, shoulder, elbow, wrist or fingers	No	Yes				
1.9	Kneeling on one or both knees	No	Yes				
1.10	If 1.9 is "Yes", knee guards issued	Yes	No				
1.11	Limitations on changing posture	No	Yes				
1.12	Whole-hand grasping with straight elbows	No	Yes				
1.13	Sustained muscle contraction of any limb for extended periods	No	Yes				
1.14	Continuous standing for more than 30 minutes	No	Yes				
1.15	Where relevant, seat provides adequate back and lumbar support	Yes	No				
1.16	Where relevant, seat provides adjustable arm support	Yes	No				
1.17	Where relevant, seat can be swiveled	Yes	No				
1.18	Hand-arm vibration from tools or equipment	No	Yes				
1.19	Whole body vibration transmitted through floor or seat	No	Yes				
1.20	Mobile equipment operator's seat can be adjusted horizontally, vertically and the seat back tilted	Yes	No				
1.21	Mobile equipment operator's seat firmly mounted to cabin floor	Yes	No				
1.22	Vibration transmitted through mobile equipment controls	No	Yes				
1.23	Mobile equipment operator's view restricted while operating or travelling	No	Yes				
1.24	Total for workplace/task:	0					
2	2 Ergonomic factors for individual employee, as determined by Occupational Health or Occupational Medical Practitioner						
2.1	Age 50 years or less	Yes	No				
2.2	Gender	Male	Female				
2.3	Body mass index 20 to 35	Yes	No				
2.4	Reasonable level of fitness	Yes	No				
2.5	Reasonable nutritional status	Yes	No				
2.6	General health good	Yes	No				
2.7	Previous occurrence of injuries/disorders/complaints involving neck, back, shoulder, elbow	No	Yes				
2.8	Previous occurrence of injuries/disorders/complaints involving hand/fingers	No	Yes				
2.9	Tobacco use	No	Yes				
2.10	Alcohol use	No	Yes				
2.11	Total for individual employee:	0					
3	Total for individual employee in this workplace/task (1.16 + 2.11):	0					
RISK CLASSIFICATION							
Workplace or Task: 0 to 7 Insignificant; 8 to 15 Moderate; 16 to 23 Significant							
Individual employee: 0 to 2 Insignificant; 3 to 7 Moderate; 8 to 10 Significant							
Individual employee in this workplace or performing this task: 0 to 10 Insignificant; 11 to 22 Moderate; 23 to 33 Significant							

References

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- (3) Hermanus MA. Occupational health and safety in mining-status, new developments, and concerns. *The Journal of the South African Institute of Mining and Metallurgy* 2007;107:531-538.
- (4) Hentschel T, Hruschka F, Priester M. Global report on artisanal and small scale mining. Summary Report commissioned by MMSD 2002.
- (5) DME. Mine Health and Safety Act, of 1996. Department of Minerals and Energy, Pretoria Government Printers.1996;29.

SUMMARY BOX

Health and Safety deficiencies in small-scale mining require access to tools that will raise awareness.

OREOHS is a tool which is a comprehensive model for hazard identification and risk assessment of occupational health stressors

Flow-diagrams indicate the important factors and areas to be audited in the workplace.

Checklists are intended for use by mine practitioners with limited experience in identifying workplace hazards and assessing risks.