DEPARTMENT OF MINERAL RESOURCES AND ENERGY

NO. 1755 **11 February 2022**

MINE HEALTH AND SAFETY ACT, 1996 (ACT NO 29 OF 1996)

GUIDELINE FOR A MANDATORY CODE OF PRACTICE FOR AN OCCUPATIONAL HEALTH PROGRAMME (OCCUPATIONAL HYGIENE AND MEDICAL SURVEILLANCE) FOR NOISE

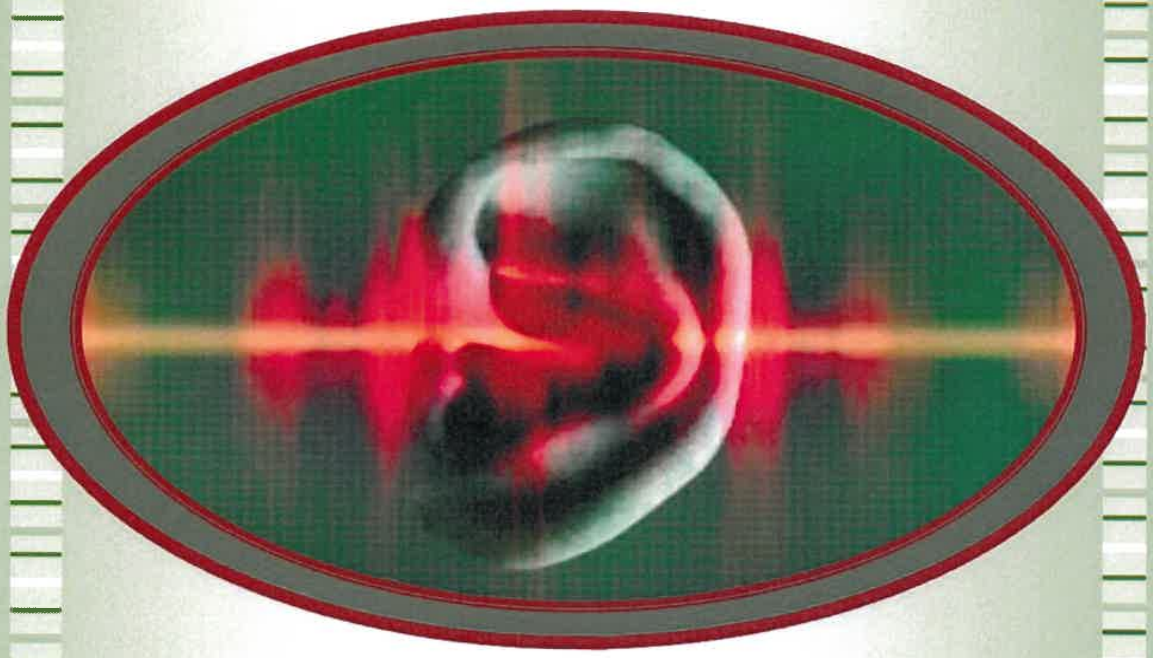
I **DAVID MSIZA,** Chief Inspector of Mines, under section 49 (6) of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) and after consultation with the Council, hereby issues the guideline for an occupational health programme (occupational hygiene and medical surveillance) for thermal stress in terms of the Mine Health and Safety Act, as set out in the Schedule.

DAVID MSIZA
CHIEF INSPECTOR OF MINES

SCHEDULE

GUIDELINE FOR THE COMPILATION OF A MANDATORY CODE OF PRACTICE FOR

Occupational Health Programme
(occupational hygiene and medical surveillance)
for
Noise



MINE HEALTH AND SAFETY INSPECTORATE

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DEPARTMENT OF MINERAL RESOURCES AND ENERGY

MINE HEALTH AND SAFETY INSPECTORATE

GUIDELINE FOR THE COMPILATION OF A MANDATORY CODE OF PRACTICE FOR AN OCCUPATIONAL HEALTH PROGRAMME (OCCUPATIONAL HYGIENE AND MEDICAL SURVEILLANCE) FOR NOISE

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PART A: THE GUIDELINE

1. FOREWORD

1.1. The commission of inquiry into safety and health in the mining industry chaired by Honourable Justice R. N. Leon identified occupational health as one of the four major issues affecting occupational health and safety in the South African mining industry.

1.2. In an attempt to address this issue a tripartite sub-committee was established under the auspices of the **MOHAC**. The **MOHAC** found it necessary that in order to address this issue a guideline for a mandatory **COP** for an occupational health programme for **noise** be drafted.

1.3. Significant risks to health exist in mining. In order to protect, monitor and promote employees' health status, an occupational health programme is required where exposure to such significant risks occur. The **MOHAC** considered it appropriate to prepare guidelines covering both occupational hygiene and medical surveillance to ensure compliance and uniform standards.

1.4. Where the employer's risk assessment indicates a need to establish and maintain a system of occupational hygiene measurements, or where such system is required by regulation, the employer must prepare and implement a **COP** based on this guideline.

1.5. This **DMRE** guideline will assist employers with the establishment of an occupational **hearing conservation programme**, but does not stipulate specific requirements for specific circumstances. It sets out a basic system for managing risk to health. The first component of any management system is finding out what the situation is, the second is deciding what to do about it, and the third is to implement appropriate controls.

1.6. This guideline replaces the earlier *guideline for the compilation of a mandatory **COP** for an occupational health programme for **noise*** with reference number DMR 16/3/2/4-A3 published by the **DMRE** in 2003.

1.7. This guideline should be read in conjunction with **SANS 10083**, instruction 171 and the *guideline for the compilation of a mandatory **COP** on minimum standards of fitness to perform work at a mine* (reference number DMR 16/3/2/3-A3) and the *guidance note for the implementation of **STS** in medical surveillance of **NIHL*** (reference number DMR 16/3/2/3-B8).

2. LEGAL STATUS OF GUIDELINES AND COPs

2.1. In accordance with section 9(2) of the **MHSA** an employer must prepare and implement a **COP** on any matter affecting the health and safety of employees and other persons who may be directly affected by activities at the mine if the **CIOM** requires it. These **COPs** must comply with any relevant guidelines issued by the **CIOM** [section 9(3) **MHSA**]. Failure by the employer to prepare or implement a **COP** in compliance with this guideline is a breach of the **MHSA**.

3. OBJECTIVES OF THE GUIDELINE

3.1. The objective of this guideline is to enable the employer at every mine to compile a **COP** which, if properly implemented and complied with, would assist in protecting the health of employees at the mine by **monitoring** and reducing their exposure to **noise**. This guideline provides guidance of a general nature on the required format and content for the **COP** and details sufficient technical background to enable the drafting committee at the mine to prepare a comprehensive and practical **COP** for their mine. This guideline sets out the two components of an occupational health programme namely:

3.1.1. Occupational hygiene

The employer is required in terms of regulation 9.2(2) or section 12 of the **MHSA** to establish and maintain a system of occupational hygiene measurements in respect of occupational exposure to **noise**.

3.1.2. Medical surveillance

The employer is required in terms of section 13 or regulation 11.4 of the **MHSA** to establish and maintain a system of medical surveillance.

4. DEFINITIONS AND ACRONYMS

4.1. **"A-weighted sound pressure level or sound level (L_{pA})"** means the sound pressure level in decibels, of **A-weighted sound pressure** given by the following equation (**SANS 10083**):

$$L_{pA} = 10 \log \left(\frac{p_A}{p_0} \right)^2$$

Where:

a) L_{pA} is the **A-weighted sound pressure level**.

b) P_A is the A-weighted pressure in pascal.

c) p_0 is the reference sound pressure (20 μPa).

4.2. **"Baseline audiogram"** means an audiogram conducted for purposes of regulation 11.4 (4) of the **MHSA** to establish a reference against which subsequent audiograms can be compared.

4.3. **"CIOM"** means Chief Inspector of Mines.

4.4. **"COIDA"** means the Compensation for Occupational Injuries and Diseases Act (Act 130 of 1993).

4.5. **"CI"** means confidence interval.

4.6. **"COP"** means Code of Practice.

4.7. **"DMRE"** means the Department of Mineral Resources and Energy.

4.8. **"Decibel (dB)"** means the logarithmic unit for quantifying the level of a sound, where the base of the logarithm is the 10^{th} root of 10 and the quantity concerned is proportional to power, relative to a reference level of 20 micro P_a.

4.9. **"Decibel, A-weighted (dBA)"** means the logarithmic unit for the level of a sound, as measured using a sound level meter's A-weighting network, which network applies weighting to the values for constituent frequencies of a sound in accordance with the human ear's sensitivity to it.

4.10. **"ENT specialist"** means ear, nose and throat specialist.

4.11. **"Equivalent continuous A-weighted sound pressure level** ($L_{Aeq,\,T}$)" means the value of the **A-weighted sound pressure level** in decibels, of a continuous steady sound that, during a specified time interval (T), has the same mean square sound pressure as a sound under consideration, the level of which varies with time, and it is defined by the following equation (**SANS 10083**):

$$L_{Aeq,\,T} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p^2 A(t)}{p^2 o} \, dt \right]$$

Where:

- $L_{Aeq,\,T}$ is the **equivalent continuous A-weighted sound pressure level**, in decibels, determined over a time interval T that starts at t_1 and ends at t_2.
- p_o is the reference sound pressure level ($p_o = 20\ \mu Pa$).
- $p_A(t)$ is the instantaneous **A-weighted sound pressure** of the sound signal, in pascal.

4.12. **"Hearing conservation"** means the prevention or minimisation of **noise**-induced hearing impairment by the implementation of **hearing conservation** procedures.

4.13. **"Hearing conservation programme"** means the process aimed at the prevention of hearing impairment, involving the implementation of the following measures:

a) Assessment and prediction of **noise** exposure in all working places which may be accessed by any person.

b) The reduction of the 8-hour rating level where this is expected to exceed the **noise** rating limit for **hearing conservation**.

c) The introduction of a prohibition to persons entering such a working place unless such person is adequately protected.

d) The introduction of a medical surveillance programme for all employees working in such working places.

e) The introduction of a follow-up assessment programme as contemplated in (a) and (b) above.

4.14. **"Hz (Hertz)"** means the derived unit of frequency and is defined as one cycle per second.

4.15. **"Homogeneous exposure group (HEG)"** means a group of employees whose exposures to **noise** has been determined to be statistically similar enough that, by **monitoring** a representative number of individuals in the group, the exposures of the remaining workers can be defined.

4.16. **"ISLM"** means integrating sound level meter.

4.17. **"kHz (kilohertz)"** means a measure of frequency equivalent to 1 000 cycles per second.

4.18. **"$L_{Aeq,\ 8h}$"** means the 8-hour **equivalent continuous A-weighted sound pressure level** in decibels and is the steady sound pressure level which would in the course of an 8-hour period deliver the same A-weighted sound energy as that due to the actual **noise** on any particular representative working day.

4.19. **"MOHAC"** means the Mining Occupational Health Advisory Committee.

4.20. **"Monitoring"** means the repetitive and continued observation, measurement and evaluation of health, and/or environmental or technical data, according to prearranged schedules, using nationally or internationally acceptable methodologies.

4.21. **"MHSA"** means Mine Health and Safety Act, 1996 (Act 29 of 1996) as amended.

4.22. **"MHSC"** means the Mine Health and Safety Council.

4.23. **"NIHL"** means **noise**-induced hearing loss.

4.24. **"Noise"** means unwanted sound that could adversely affect health.

4.25. **"Noise zone"** means an area within which the **noise** equals or exceeds the **OEL**.

4.26. **"Occupational exposure limit (OEL) for noise"** means the value of the 8-hour rating level ($L_{Aeq,\ 8h}$), at or above 85 **dBA** which hearing impairment is likely to result.

4.27. **"OMP"** means Occupational Medical Practitioner.

4.28. **"Percentile"** means the value of a variable below which a certain percent of observations fall. For example, the 20th **percentile** is the value (or score) below which 20 percent of the observations may be found. The term **percentile** and the related term **percentile** rank are often used in the reporting of scores from norm-referenced tests.

The 25th **percentile** is also known as the first quartile (Q_1), the 50th **percentile** as the median or second quartile (Q_2), and the 75th **percentile** as the third quartile (Q_3).

4.29. **"PPE"** means personal protective equipment.

4.30. **"PLH"** means percentage loss of hearing.

4.31. **"RMS"** means root-mean-square.

4.32. **"Sampling cycle"** means the planned sampling programme for the year, which must terminate at the end of each calendar year.

4.33. **"SANS 1451"** means:

a) SANS 1451-1 (Ed. 1.02): Hearing protectors part 1: ear-muffs.

b) SANS 1451-2 (Ed. 1.01): Hearing protectors part 2: ear-plugs.

c) SANS 1451-3 (Ed. 1.03): Hearing protectors part 3: ear-muffs attached to an industrial safety helmet, or as amended from time to time.

4.34. **"SANS 10083"** means the measurement and assessment of occupational **noise** for **hearing conservation** purposes, or as amended from time to time.

4.35. **"SD"** means standard deviation.

4.36. **"SLM"** means sound level meter.

4.37. **"Standard threshold shift (STS)"** means an average change in hearing of 10 **dB** or more at the frequencies of 2 000 **Hz**, 3 000 **Hz** and 4 000 **Hz** in one or both ears, as compared to the employee's **STS baseline audiogram**.

4.38. **"STS baseline"** means the initial audiometric value determined at the first **STS** testing, and it is the better of the employee's two audiograms performed by an audiometrist on the same day that do not differ from each other by more than 10 **dB** for any of the frequencies in the 2 000 **Hz**, 3 000 **Hz** and 4 000 **Hz** test ranges.

5. SCOPE

5.1. This guideline covers a basic occupational health programme to assist in protecting employees from occupational **NIHL**. It further provides for the measurement of occupational exposures to **noise** and the linking of these exposures to employee medical records.

5.2. By virtue of regulations 9.2(1) and 9.2(2) of the **MHSA**, the employer is required to:

5.2.1. Ensure that occupational exposure to **noise** is maintained below the **OEL**.

5.2.2. Establish and maintain a system of occupational hygiene measurements, as contemplated in section 12 of the **MHSA**, of all working places where the **noise** exposure level ≥82 **dB** $L_{\text{Aeq, 8h}}$.

5.3. This guideline will assist the employer to comply with these statutory requirements.

5.4. This guideline will also assist the employer in covering, in the COP:

5.4.1. A **noise monitoring** programme component of the **hearing conservation programme** (from ≥82 **dB** $L_{\text{Aeq, 8h}}$).

5.4.2. A formal **hearing conservation** programme which includes medical surveillance (≥85 **dB** $L_{Aeq,\,8h}$).

6. MEMBERS OF THE TASK TEAM

6.1. Occupational hygiene review sub-committee:

STATE	EMPLOYEES	EMPLOYERS
C. Kekana	M. Grant	B. Mongoma
N. Mokhonoana	T. Mpete	W. Deysel
B. Novolo		K. Motseme
		S. Talane

6.2. Occupational medicine review sub-committee:

STATE	EMPLOYEES	EMPLOYERS
Dr L. Ndelu	I. Sakala	Dr P. Lakha
Dr D. Mokoboto	N. Prinsloo	
M. A. Hlapane		
D. Mahlaba		

PART B: AUTHOR'S GUIDE

1. The **COP** must, where possible, follow the sequence laid out in Part C: Format and content of the **COP**. The pages as well as the chapters and sections must be numbered to facilitate cross-referencing. Wording must be unambiguous and concise.

2. It should be indicated in the **COP**, and on each annexure to the **COP** whether:

2.1. The annexure forms part of the **COP** and must be complied with or incorporated in the **COP**, or whether aspects thereof must be complied with or incorporated in the **COP**.

2.2. The annexure is merely attached as information for consideration in the preparation of the **COP** (i.e. compliance is discretionary).

3. When annexures are used the numbering should be preceded by the letter allocated to that particular annexure and the numbering should start at one (1) again. (e.g. 1, 2, 3, A1, A2, A3,).

4. Whenever possible illustrations, tables, graphs and the like should be used to avoid long descriptions and/or explanations.

5. When reference has been made in the text to publications or reports, references to these sources must be included in the text as footnotes or side notes as well as in a separate bibliography.

PART C: FORMAT AND CONTENT OF THE MANDATORY COP

1. TITLE PAGE

1.1. The **COP** should have a title page reflecting at least the following:

1.1.1. Name of mine.

1.1.2. The heading: "Mandatory Code of Practice for an Occupational Health Programme for **Noise**".

1.1.3. A statement to the effect that the **COP** was drawn up in accordance with **DMRE** guideline, reference number **DMRE** 16/3/2/4-B7 issued by the **CIOM**.

1.1.4. The mine reference number for the **COP**.

1.1.5. The effective date.

1.1.6. Revision dates (if applicable).

1.1.7. Mine code number.

2. TABLE OF CONTENTS

2.1. The **COP** must have a comprehensive table of contents.

3. STATUS OF THE MANDATORY COP

3.1. This section must contain statements to the effect that:

3.1.1. The **COP** was drawn up in accordance with reference number **DMRE** 16/3/2/4-B7, issued by the **CIOM**.

3.1.2. This is a mandatory **COP** in terms of section 9(2) and (3) of the **MHSA**.

3.1.3. The **COP** may be used in an accident investigation / inquiry to ascertain compliance, and also to establish whether the **COP** is effective and fit for purpose.

3.1.4. The **COP** supersedes all previous relevant **COPs**.

3.1.5. All managerial instructions, recommended procedures (voluntary **COPs**) and standards on the relevant topics must comply with the **COP** and must be reviewed to ensure compliance.

4. MEMBERS OF THE DRAFTING COMMITTEE

4.1. In terms of section 9(4) of the **MHSA** the employer must consult with the health and safety committee on the preparation, implementation or revision of any **COP**.

4.2. It is recommended that the employer should, after consultation with the employees in terms of the **MHSA**, appoint a committee responsible for the drafting of the **COP**.

4.3. The members of the drafting committee assisting the employer in drafting the **COP** should be listed giving their full names, designations, affiliations and experience. This committee must include competent persons, sufficient in number, to effectively draft the **COP**.

5. GENERAL INFORMATION

5.1. General relevant information relating to the mine must be stated in this section of the **COP**.

5.2. The following minimum information must be provided:

5.2.1. A brief description of the mine and its location.

5.2.2. The commodities produced.

5.2.3. The mining method or the combination of methods used at the mine must be listed. This section must discuss the degree of mechanisation, taking care to identify the potential **noise** sources.

5.2.4. Other related **COPs** and management standards must be reviewed concurrently in order to avoid conflict of requirements as laid down by the mine. The objective would be to have an integrated system.

5.2.5. The unique features of the mine that have a bearing on this **COP** should be cross-referenced to the risk assessment conducted.

6. TERMS AND DEFINITIONS

6.1. Any word, phrase or term of which the meaning is not absolutely clear, or which will have a specific meaning assigned to it in the **COP**, must be clearly defined. Existing and/or known definitions should be used as far as possible. The drafting committee should avoid jargon and abbreviations that are not in common use or that have not been defined. The definitions section should also include acronyms and technical terms used.

7. RISK MANAGEMENT

7.1. Section 11 of the **MHSA** requires the employer to identify hazards, assess the health and safety risks to which employees may be exposed to while at work, and record the significant hazards identified and the risks assessed. The employer must determine how the significant risks identified in the risk assessment process must be dealt with. This should be done with regard to the requirement of section 11(2) and (3) of the **MHSA** that, as far as reasonably practicable, attempts should first be made to:

- Eliminate the risk.
- Thereafter, control the risk at source.
- Thereafter, minimise the risk.
- Thereafter, insofar as the risk remains, provide **PPE** and institute a programme

to monitor the risk.

7.2. To assist the employer with the risk assessment, all possible relevant information such as health statistics, ergonomic studies, research reports, manufacturers' specifications, approvals, design criteria and performance figure for all relevant equipment should be obtained and considered.

7.3. In addition to the periodic review required by section 11(4) of the **MHSA**, the **COP** should be reviewed and updated after significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment, and material.

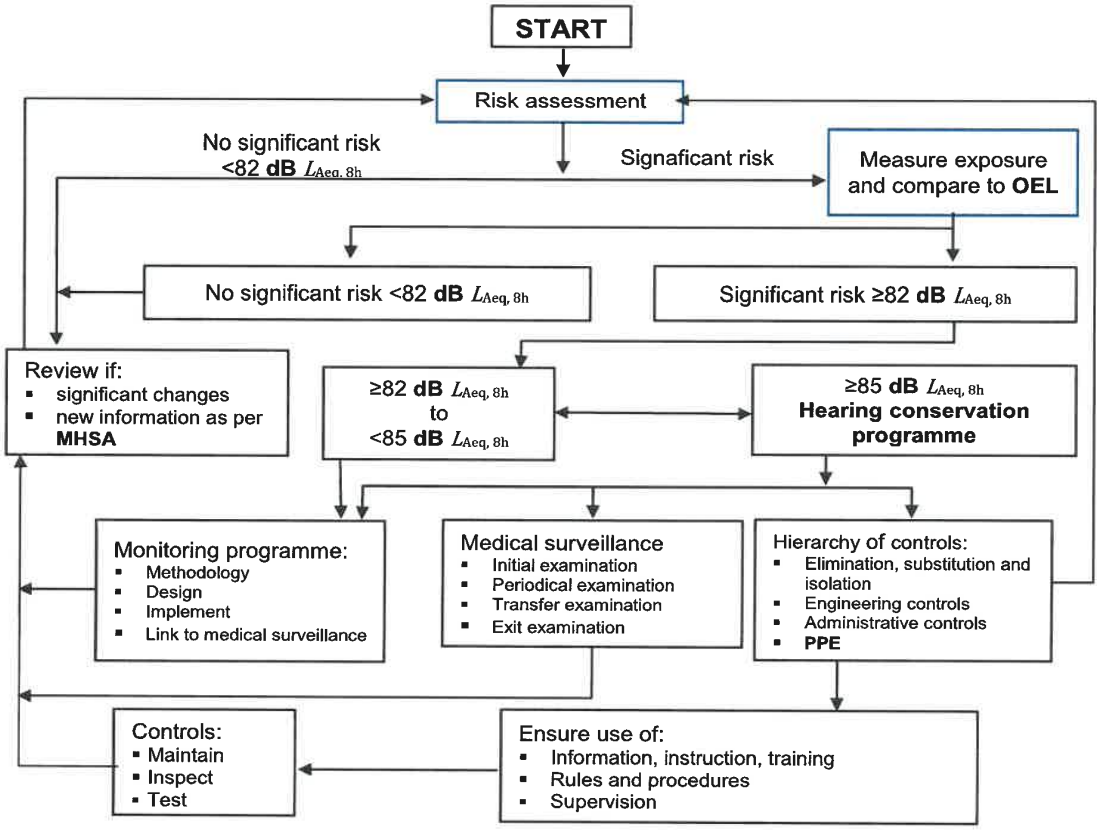
8. ASPECTS TO BE ADDRESSED IN THE COP

Every employer must establish and maintain a system of occupational hygiene measurements and a system of medical surveillance that addresses the following elements:

8.1. Occupational health programme

The occupational health programme for **noise** to be implemented on the mine must be summarised in the **COP** in a flow chart similar to Figure 1 below.

FIGURE 1: Occupational health programme for noise



8.1.1. Risk assessment

The **COP** should set out measures to ensure that:

(i) A qualitative and quantitative risk assessment process is followed and considers all the factors influencing the health of employees.

(ii) The outcomes of the risk assessment will be utilised as inputs into the occupational health programme.

(iii) Risk assessment will be carried out by a multi-disciplinary team including, but not limited to, the section 12 (1) appointee and section 13 (3) appointee of the **MHSA**.

(iv) Where the available historical data is not sufficient to enable professional judgement, acceptable risk assessment methodologies should be used.

NOTE:
Chapter 3 of the handbook published by the Safety in Mines Research Advisory Committee (SIMRAC), the *Handbook on Occupational Health Practice in the South African mining industry*, may be consulted, and any other methodology, to assist in conducting a risk assessment.

The **COP** must address the points set out below:

8.1.1.1. Baseline risk assessment

At the initial commencement of a system of occupational hygiene measurements, as contemplated in section 12(2) of the **MHSA,** a baseline risk assessment as contemplated in section 11 of the **MHSA** is to be conducted to assess the exposure to **noise**.

The **noise** baseline risk assessment must as a minimum, address the following:

a) Conducting of **noise** measurements as per the **noise monitoring** strategy specified.

b) The areas on surface or underground where such **noise** sources may be present e.g. stope, face, development end, workshops, crushers, etc.

c) The nature of the key working place operations and activities that pose the greatest potential for exposure to **noise**.

d) Prioritization of the significant **noise** sources i.e. ≥82 **dBA**, for **noise** management purposes, based on the workplace **noise** measurements conducted.

e) The occupations and number of employees who are being exposed to significant **noise** levels i.e. ≥82 **dB** $L_{Aeq,\,8h}$.

f) The pattern, i.e. intermittent, continuous etc., the duration and the frequency of employee exposure to **noise** sources identified.

g) The actual exposure levels measured compared to the **OEL** per working shift e.g. day shift and night shift. Where the available historical **noise** data is insufficient to enable professional judgement regarding the extent of any risk, acceptable statistical methodologies should be used for this determination process.

h) The control measures in place, i.e. substitution, engineering, administration (including education and training), **noise** demarcation zones, **PPE** etc.

i) The additional control measures required to be instituted to reduce or maintain to below the **OEL** and, if applicable, the planned programme of implementation.

j) The frequency of any ongoing **monitoring** to assess the effectiveness of the controls.

NOTE:
For the purpose of risk assessment, the commodity codes (and description), activity codes (and description) and occupational codes (and description) as set out in Annexure A: Mandatory codes should be used.

8.1.1.2. Review of risk assessment

The **COP** must address the review of the risk assessment whenever circumstances arise or change at the mine that could have an impact on the original assessments and at least in the following instances:

a) When outcomes of medical surveillance programmes indicate the need for it.

b) When a section 11(5) investigation of the **MHSA** and/or any other investigation(s) indicates the need.

c) When new or revised legislation is introduced.

d) When new mining methods are introduced.

e) When process changes are introduced (e.g. in process plants).

f) When new types of machinery are introduced.

g) On an annual basis, based on the **noise** measurements conducted as per the **noise monitoring** strategy specified under 8.2.1.4 below of the previous cycle.

8.1.2. Management of risk

8.1.2.1. Non-significant risk

The employer should put measures in place to ensure that a portfolio of evidence for **noise** measurements <82 **dB** $L_{Aeq,\,8h}$ be established and maintained.

8.1.2.2. Significant risk

The employer must ensure that a system of **noise** measurements consisting of area, source and personal exposure **monitoring**, is implemented for all workplaces with a **noise** level of ≥82 **dB** $L_{Aeq,\ 8h}$.

8.2. Hearing conservation programme

The **COP** should put measures in place to ensure that a **hearing conservation programme** be established and maintained for **all** workplaces with a **noise** level of ≥85 **dB** $L_{Aeq,\ 8h}$.

The **hearing conservation programme** should address the following aspects:

8.2.1. Occupational hygiene

8.2.1.1. Structure of the **hearing conservation programme**

The **COP** should put measures in place for the development and implementation of a functional structure with clearly defined roles and responsibilities based on the need to coordinate critical activities within the **hearing conversation programme**.

The employer should establish a **hearing conservation** committee and appoint the following members (but not limited to):

a) Employer representative (chairperson).

b) Section 12(1) appointee of the **MHSA**.

c) Engineer for **noise** control purposes.

d) Procurement representative.

e) **OMP** of the **MHSA**.

f) Human Resources Development representative (education and training).

g) Fulltime health and safety representative.

8.2.1.2. Risk assessment

The outcomes of the risk assessment will be utilised as inputs into the **hearing conservation programme**.

8.2.1.3. Determination of **HEGs**

The **COP** must address the points set out below:

8.2.1.3.1. The **HEGs** must be identified for purposes of personal exposure **monitoring**. The baseline risk assessment will enable the initial identification of **HEGs**, which will be established as follows:

Step 1

Sub-divide the mine into sampling areas (i.e. surface = sampling area 1, underground section A = sampling area 2, underground section B = sampling area 3, underground section C = sampling area 4, etc.).

Step 2

The sub-division of the sampling areas into activity areas as per the activity area code list found under Annexure A: Mandatory codes which must be complied with.

Step 3

Ensure that adequate measurements of personal **noise** exposures (also refer to paragraph 8.2.1.4.3 below) are taken in line with the identified activity areas. If sufficient historical personal exposure data is not available regarding the extent of the risk, a personal **monitoring** survey must be undertaken for each identified activity area. Acceptable methodology on personal **monitoring** as stipulated by **SANS 10083** should be used for this assessment.

Step 4

A statistical analysis (Annexure B: **HEG** determination - example of statistical approach is attached for information purposes only) of the personal **noise** measurement results obtained from the previous **sampling cycle**, or baseline **noise** survey for new **HEGs**, should be conducted as part of the determination and evaluation of **HEGs**.

The results of the statistical analysis conducted for the determination and evaluation of each **HEG** should be compared to the classification bands for personal **noise,** tabled in Annexure C: Mandatory classification bands.

NOTE:
An activity area e.g. stoping is not a **HEG**, this activity area i.e. stoping, must be further sub-divided into **HEGs**.

8.2.1.3.2. At the end of each **sampling cycle** (annually at the end of a calendar year) sampling results for each **HEG** must be statistically analysed and re-classified. Re-classification of **HEGs** should be done by means of statistical analysis based on the 90th **percentile** of all measurement results for the previous **sampling cycle**.

The total number of exposed employees will be determined at the beginning of an annual reporting cycle and would only change if there is an increase in employees during the quarterly reporting cycle (exposed individuals are only counted once in an annual reporting cycle to prevent duplicate counting).

NOTE:
In the event where a number of employees changes from quarter to quarter, the employer must indicate such changes in the comments section of the reporting form.

Reduction in employees would not reduce the total number of exposed employees during the reporting cycle.

8.2.1.3.3. **HEGs** must be re-assessed whenever circumstances arise or change at the mine when the following occurs:

a) Exposure levels change due to controls being initiated and likewise, when controls deteriorate.

b) Employee complaints are received.

c) Processes are changed (e.g. change in procedures, mining layouts, mining methods, plant, equipment or material).

d) Occupational illness related to **noise**.

e) A change in exposure category based on the results of a trend analysis.

f) Other events warranting re-evaluation such as:

(i) New technological data.

(ii) New regulatory initiatives.

8.2.1.4. **Noise monitoring** strategy

The **COP** should cover the following types of **noise monitoring**:

8.2.1.4.1. Area **noise monitoring**

The **COP** should set out measures to ensure the following:

a) Area **noise monitoring** should be conducted in accordance with **SANS 10083**.

b) Area **noise monitoring** should be conducted to determine the boundaries of **noise zones** for purposes of demarcation. The following should be considered:

(i) Assessment and prediction of **noise** exposure in all working places which may be accessed by any person.

(ii) The reduction of the 8-hour rating level where this is expected to exceed the **OEL** for **hearing conservation**.

(iii) The introduction of a prohibition to persons entering such a working place unless such person is adequately protected.

(iv) The introduction of a medical surveillance programme for all employees working in such working places.

(v) The introduction of a follow-up assessment programme as contemplated under (i) and (ii) above.

(vi) All **noise zones** to be clearly demarcated on a mine plan or sketch.

NOTE:
Personal **noise** exposure measurement results must not be used for the determination of **noise zones**.

8.2.1.4.2. **Noise** source **monitoring**

The **COP** should set out measures to ensure the following:

a) The **noise** source **monitoring** should be conducted in accordance with the **noise** guidance note (Annexure F: Guidance note for **noise** measurement of equipment to ensure conformance with **MHSC** milestones attached is for information purposes only).

b) That **noise** source **monitoring** is conducted to identify and record **noise** source(s) from 82 **dBA** for maintaining and managing purposes. (Annexure E: **Noise** register template is attached for information purposes only).

c) That the **noise** sources emitting **noise** level ≥ **OEL** are included in the **hearing conservation programme** and managed by the appointed functional structure in terms of this **COP**.

d) The data collection on the **noise** sources will be based on sampling a minimum of 5% (or a minimum of five if there is less than 100 pieces of that particular equipment type) of that equipment type total population over a 12-month period (samples should be representative of the various activities).

e) **Noise** source data will be recorded using rolling log averages on a quarterly basis (Annexure E: **Noise** register template is attached for information purposes only).

NOTE:
Personal **noise** exposure measurement results must not be used for the determination of **noise** sources.

8.2.1.4.3. Personal **noise** exposure **monitoring**

The **COP** should set out measures to ensure the following:

a) The personal **noise monitoring** should be conducted in accordance with **SANS 10083**.

b) Personal exposure **monitoring** is conducted to obtain representative results of employee shift exposures in a workplace. Samples taken according to the established **monitoring** schedule should be:

(i) Evenly spread per quarter over a full **sampling cycle** period for each **HEG**.

(ii) Randomly spread over each quarter.

(iii) Randomly spread across all occupations within the **HEG**.

c) A sampling strategy including a **monitoring** schedule for each **HEG** is compiled for the cycle period (annually), and records thereof are kept in line with section 12(3) of **MHSA**.

d) Sampling size and frequency.

e) The total number of samples should be evenly spread per **HEG** (and occupations within the **HEG**) and should be taken as per classification bands in Annexure C: Mandatory classification bands as per the following:

(i) Category A: 5% or five samples (whichever is greater) per quarter.

(ii) Categories B and C: 5% or five samples (whichever is greater) per annum, to be evenly spread per quarter.

(iii) Category D: no sampling scheduled for this category. Measurement results that are below 82 **dBA** of the **OEL** will be reported under this category. A portfolio of evidence should be kept.

f) A section 12(1) appointee of the **MHSA** should use their professional judgment to decide whether additional samples need to be taken to confirm that **HEGs** are appropriately classified.

8.2.1.5. Quality control

The **COP** must set out measures to ensure a quality control programme is developed and implemented, taking into account the following, but not limited to:

a) Instrumentation(s) used for a **noise monitoring** strategy must comply with the **SANS 10083.**

b) Measurement methods.

c) Competency of people conducting **noise** measurements.

d) Reporting.

e) Maintenance and calibration.

f) The training programme in place for a person conducting the **noise** measurements to take into account the following (but not limited to):

(i) Storage and maintenance of the sampling equipment.

(ii) Issuing of the sampling equipment.

(iii) Wearer of the sampling equipment.

(iv) Handling of the sampling equipment.

(v) Transportation of equipment.

(vi) Pre- and post-calibration of the measuring instrumentation checks.

NOTE:
Refer to Annexure G: Quality assurance for **noise** measurement and recording.

8.2.1.6. Reporting and recording

The **COP** should address the following:

8.2.1.6.1. Mandatory reports

Mandatory reporting must be done on a quarterly basis for all categories, that is A, B and C (refer to Annexure C: Mandatory classification bands and Annexure D: Reporting forms).

NOTE:
- For all categories A, B and C, the measurement results on the samples taken at that time must be reported within 60 days at the end of each quarter. The logarithmic average results must be reported at the end of each quarter.
- For category D, no reporting is required, however a portfolio of evidence should be kept at the mine.

To calculate the logarithmic average exposure for a given **HEG** or an occupation / a job category, the equation below should be used:

$$L_{\text{Aeq}} = 10 \log \frac{(anti \log \frac{L1}{10} + anti \log \frac{L2}{10} + anti \log \frac{L3}{10} + anti \log \frac{L4}{10} + \cdots)}{n}$$

Where:

- L = the noise levels measured (L_{Aeq}) in **dBA**.
- n = number of total samples

8.2.1.6.2. Record keeping system

A record keeping system, which records the exposure history of each **HEG** at the mine, and any other **noise monitoring** records e.g. calibration certificates, sampling sheets, etc., should be kept and be readily available at the mine, including any reasons for deviation on sample results such as:

a) Controls not operating effectively.

b) Events or factors which have influenced the results, e.g. excessive winds.

8.2.1.7. Occupational hygiene

The **COP** should stipulate how the hierarchy of controls have been applied as per the **hearing conservation programme**, considering the following:

a) Elimination.

b) Substitution and isolation.

c) Engineering controls.

d) Administrative controls.

e) **PPE**.

8.2.2. Medical surveillance

Sections 13(2) (c) and 17 of the **MHSA** requires for a system of medical surveillance to consist of an initial medical examination, other (periodic) medical examinations at appropriate intervals, and an exit medical examination.

Regulation 11.4(2) of the **MHSA** read with sections 11(3) and 11(4) of the **MHSA** provides that the system of medical surveillance in respect of **noise** must consist of:

a) A **baseline audiogram**.

b) Periodic audiograms.

c) An exit audiogram.

d) Any additional medical surveillance required in terms of the employer's risk assessment.

8.2.2.1. Audiometry

This section details the requirements for audiometric testing procedures to be applied where a **hearing conservation programme** is required, i.e. where **noise** control engineering has not been possible or has failed to eliminate the **noise** hazard.

Audiometric testing in the absence of appropriate control measures cannot reduce the risk of **NIHL** and should not be regarded as a solution to the **noise** hazard, but as a means of identifying and prioritising problem areas to enable the formulation of appropriate interventions.

In conducting audiometric testing, the following should comply with **SANS 10083**:

8.2.2.1.1. Test frequencies for pure tone audiometric tests.

8.2.2.1.2. Test environment.

8.2.2.1.3. Audiometric equipment.

8.2.2.1.4. Maintenance and calibration of audiometric equipment.

8.2.2.1.5. Audiometric screening procedures:

a) Screening audiometric tests should include confirmation of non-exposure to **noise** levels ≥85 **dB** for at least 16 hours, otoscopic evaluation and pure-tone air conduction testing.

b) Before testing, an otoscopic examination should be conducted to ensure that there is no occluding ear wax nor any visible abnormality such as otitis media, perforation or other ear pathology, or any combination of these, that could result in the hearing loss and that (where applicable). Referral for ear wax removal to a medical practitioner for successful treatment is completed before testing is done.

8.2.2.2. Mandatory audiometric testing

The employer must conduct audiometric tests at no cost to the employee. The test must be conducted by a registered audiometrist or acoustician, under the supervision of an **ENT specialist**, **OMP** or an audiologist.

8.2.2.2.1. Baseline audiometry

a) The employer must provide for audiometric testing of the employees' hearing sensitivity for the purpose of establishing a valid **baseline audiogram** before an employee commences employment, or within 30 days of commencement of employment, or commencement of work within a **noise zone** and enrolment in a **hearing conservation programme**. A valid baseline result determined at a previous working place, shall satisfy this requirement provided that it meets the audiometric test requirement of this document.

Baseline audiograms should be used to:

(i) Determine future compensable hearing loss.

(ii) Determine the hearing status of an employee.

b) The audiometric test must be preceded by a period of at least 16 hours during which there has been no exposure to noise levels ≥85 **dB**. The use of hearing protection devices during this period that comply with the requirements of **SANS 1451** will not satisfy this requirement.

The employee should not be allowed to commence work or enter any **noise zones** prior to the conclusion of the two audiometric evaluations forming part of the determination of the employee's **baseline audiogram**.

c) A **baseline audiogram** should be conducted using screening audiometry and where the results show an abnormality, the employee should be referred to the audiologist to establish a baseline as per **SANS 10083** diagnostic battery of tests given under 8.2.2.4.3 below.

When it is not possible to obtain a valid baseline audiometric test result, the test should be repeated within 30 days of employment, or before transfer to a **noise zone**.

d) Before repeating tests to establish a baseline, it should be ensured that:

(i) The employee understands the audiometric testing procedure and is capable of responding in the required manner, re-instructing should be done when necessary.

(ii) The audiometric testing procedure is conducted correctly with equipment complying with the requirements laid down in this document.

(iii) There is no interference (such as environmental **noise**) or faulty equipment (such as a patient response button working intermittently) that could prevent the successful completion of valid baseline testing.

(iv) The particular tests used to determine a valid baseline were conducted on the same day. Results obtained on a previous day should be discarded and not used together with results obtained on another day to obtain a valid result.

When it is not possible for the audiometrist, after repeated testing, to obtain a valid baseline test result, the employee should be referred to an audiologist to establish a valid **baseline audiogram**.

NOTE:
The instruction 171 baseline (refer to Annexure H: Instruction 171) that is done on a person entering the mining industry for the first time will be the baseline for the rest of his/her working career.

The **STS baseline audiograms** would have been completed by December 2017, as per the **DMRE** guidance note for the implementation of **STS** in the medical surveillance of **NIHL**. This baseline is repeated at every new employer, because it is used for the purpose of assisting the employer in preventing **NIHL**.

For someone entering the mining industry for the first time the instruction 171 **baseline audiogram** may be used as the **STS baseline audiogram**, at the first employer only.

8.2.2.2.2. Revised baseline audiometry

a) The instruction 171 baseline is revised when the employee has been compensated for **NIHL**, in which case the compensation audiogram becomes the new baseline.

b) The **STS baseline** is revised when there is an average change in hearing of 25 **dB** or more, at the frequencies of 2 000 **Hz**, 3 000 **Hz** and 4 000 **Hz** in one or both ears, as compared to the employee's **STS baseline audiogram**.

c) Both revised baselines must be diagnostic audiograms.

8.2.2.2.3. Initial screening audiometry

During an initial medical examination for an employee, the employer must conduct two screening audiograms to obtain the **STS baseline**. In the case of a person entering the mining industry for the first time, this would also serve as the instruction 171 baseline.

8.2.2.2.4. Periodic screening audiometry

a) Periodic audiometry

The employer must conduct periodic audiometric evaluations on an annual basis for all employees having **noise** exposure levels that equal or exceed 85 **dBA**. Where employees are exposed to an 8-hour rating level equal to or in excess of 105 **dBA**, tests should be conducted at intervals not exceeding six months.

(i) Periodic audiometric evaluation shall be preceded by a period of at least 16 hours during which there has been no exposure to **noise** levels that is equal to or in excess of 85 **dBA**. The use of hearing protection devices during this period, even if it complies with the attenuation requirements of **SANS 10083**, will not satisfy this requirement.

(ii) Before testing, an otoscopic examination shall be conducted on the external ear canals of an employee. It should be ensured that there is no visible abnormality such as otitis media, perforation or other ear pathology (or a combination of these) that could result in the hearing loss. Where required, successful treatment shall be completed before testing is done.

(iii) Obtain and record the medical history of the employee with relevance to previous traumatic incidents, medical treatment, ototoxic medication or other non-auditory events, which could have an effect on the hearing of an employee.

b) Periodic audiometry shall be used to determine:

(i) The occurrence and extent of any **STS** i.e. to determine the need for further investigation, and to monitor the efficiency of the **hearing conservation programme**.

(ii) Whether a **PLH** shift of 10 has occurred for compensable hearing loss.

(iii) Whether the **PLH** shift of five has occurred for new early **NIHL**.

c) If a periodic audiometric result shows a new **PLH** shift of five or more, or a new **STS** of 25 **dB** from baseline, the employer shall refer the employee to an audiologist for diagnostic audiogram. Diagnostic battery of tests are given in 8.2.2.4.3 below.

8.2.2.3. Investigations

a) When the periodic screening audiogram indicates the following, the employer must investigate and refer the employee for the following further intervention:

(i) Early **NIHL** (intervals of a **PLH** ≥5).

(ii) Investigating the reason for the shift (re-testing including otoscopic examinations).

(iii) **STS** ≥25 **dB**; referral of the employee to an **OMP**.

(iv) Compensable hearing loss (intervals of **PLH** ≥10 from the baseline audiometry); referral for diagnostic audiology or **ENT specialist**.

b) An analysis is required as to the contribution of **noise** exposure to the hearing loss of the employee by reconciling the contributing factors to an employees' hearing loss.

c) The diagnostic audiogram(s) must be performed to confirm that the above-mentioned **PLH** or **STS** is work related, a section 11 (5) investigation of the **MHSA** must be initiated and may include amongst others, the following interventions:

(i) Retraining of employees regarding the **hearing conservation programme** and the use of hearing protectors.

(ii) The hearing protection devices used by the employee should be carefully inspected for possible shortcomings or inadequacies, and if necessary be refitted with alternative hearing protectors before allowed to re-enter the **noise zone**.

(iii) Any necessary identified steps to be taken to prevent a possible further **STS** or **PLH** shift.

d) The employer should report all cases of confirmed compensable **NIHL** to the relevant authority, as per relevant legislation.

8.2.2.4. Diagnostic audiometry

8.2.2.4.1. Diagnostic audiometry testing should be conducted by an audiologist to determine early **NIHL** (intervals of a **PLH** ≥5) or **STS** ≥25 **dB** or compensable hearing loss (intervals of **PLH** ≥10), according to the relevant legislation and the guidance note for the implementation of **STS** in medical surveillance of **NIHL**.

8.2.2.4.2. Diagnostic audiometry must be conducted using the equipment in accordance with the relevant requirements specified in **SANS 10083**.

8.2.2.4.3. The following battery of tests investigations may be done by the audiologist during diagnostic testing:

a) An otoscopic investigation to determine any visible pathology which could have led to the loss of hearing.

b) A diagnostic test in accordance with the relevant legislation to calculate the **PLH** and **STS**.

c) A pure tone conduction test at least at the frequencies as per **SANS 10083**.

d) A bone conduction test at least at the test frequencies as per **SANS 10083**.

e) A speech reception threshold test.

f) A speech discrimination test.

g) A full immittance test battery including tympanometry, ipsi- and contralateral acoustic reflex testing.

h) Oto-acoustic emission testing including transient oto-acoustic emission testing and/or distortion product emission testing (or both), if available.

i) Any other audiometric test procedures to determine the degree of hearing loss that could be ascribed to **noise** exposure.

8.2.2.4.4. In the final conclusions from the test results, due consideration should be given to the complete medical history, including the information obtained from the employer in terms of legislation. An analysis is required as to the contribution of **noise** exposure to the hearing loss of the employee.

8.2.2.4.5. When an employee is referred for diagnostic audiometry, the audiologist should consider the following:

a) All the personal details of the employee, i.e. name, address, work reference, age, identity number, etc.

b) A complete medical record of the employee.

c) A complete work record of the employee, also at previous employers, if any [see (e) and (f) below].

d) All the details of the baseline audiometry, the most recent routine screening test result and, where applicable, the exit audiometric results from the previous employer.

e) Complete details of all the workplace(s) in which the employee was exposed to **noise** levels ≥ the **OEL**, inclusive of the personal **noise** exposure levels determined by the section 12(1) appointee of the **MHSA**.

f) In the case of potential claims for **PLH** as in the relevant legislation, the details in terms of (e) above should include all previous occupations since the baseline was established. The total duration of exposure to **noise** during such occupations should be obtained where possible.

g) Full specification of the hearing protectors (including their attenuation values) which were used by the employee. Where available, the actual hearing protection equipment used should be presented.

8.2.2.4.6 Records of each person tested should be kept by the employer.

8.2.2.5. Exit audiometry

a) The employer must conduct audiometric evaluation for all persons at the conclusion of employment in a **noise zone**. The record of the audiometric evaluations shall form part of the individual's medical surveillance records and be retained in accordance with legal requirements [section15 (1) and (2), and 17 of the **MHSA**].

b) Audiometry evaluation for exit shall be preceded by a period of at least 16-hours during which there has been no exposure to **noise** levels greater or equal to 85 **dBA**. The use of hearing protection devices during this period, even if it complies with the requirements of **SANS 1451** (parts 1, 2 or 3), will not satisfy this requirement.

c) The following actions are applicable for exit audiometric evaluations:

(i) The individual's **PLH** shall be derived from the audiometric evaluation using the approved frequency-specific tables and compared with the **PLH** derived from the **baseline audiogram**.

(ii) Where the audiometric evaluation indicates an increase in **PLH** of 10 or greater relative to the baseline audiometric evaluation, and is confirmed by repeat audiometry evaluations, the individual shall be referred for diagnostic audiometry. If no **baseline audiogram** is available, it will be assumed that the individual's hearing was normal before exposure to **noise**.

(iii) Where an individual is referred for a diagnostic audiogram as contemplated in the preceding point, the **PLH** derived from it, and any increase in **PLH** relative to the **baseline audiogram**, shall be entered in the individual's record of medical surveillance [section 17(4)(b) of the **MHSA**]. If the diagnostic audiogram confirms a **PLH** shift of 10 or more, the employee should be referred to the relevant compensation body.

(v) The audiogram and the **PLH** derived from it shall be recorded on the individual's exit certificate [section 17(1)-(4) of the **MHSA**], and a copy of the exit certificate shall be entered in the individual's record of medical surveillance [section 17(4) (b) of the **MHSA**].

(vi) Any employee diagnosed with a **PLH** shift of 5% or an **STS** of 25 **dB** for the first time on exit should have the relevant investigation as stated in 8.2.2.3 above.

d) The employer must ensure that the employee is given a copy of the following on exit:

(i) The employee's exit certificate.

(ii) A copy of the employee's record of hazardous work (**DMRE** 276).

(iii) Baseline audiometric evaluation results.

(iv) The results of the exit audiometric test.

8.2.2.6. Confidentiality

Employees' records of medical surveillance must be kept confidential in line with section 15(1) of the **MHSA**.

Ethical standards should be followed by all professionals involved in the **hearing conservation programme** referred to in this document.

8.2.3. Training and awareness of employees

8.2.3.1. The employer must provide training to employees exposed to **noise** levels ≥82 **dBA** within 30 days of employment and periodic training must be conducted at intervals of at least 12 months.

Training must include the following:

a) The effects of **noise** on hearing.

b) The purpose and value of wearing hearing protectors.

c) The advantages and disadvantages of the hearing protectors to be offered.

d) The various types of hearing protectors offered by the employer and the care, fitting and use of each type.

e) The employer shall make copies of this guideline available to affected employees or their representatives, and shall keep a copy at the workplace.

f) The employers' and employees' respective responsibilities in maintaining mine **noise** controls.

g) The purpose and value of audiometric testing and a summary of the procedures.

8.2.3.2. The employer must keep proof of records of all formal training for each employee indicating the date and content. The employer shall provide, upon request, all materials relating to the employees' training and education programme pertaining to this guideline to the **DMRE**. It is recommended that employers also keep records of all informal training regarding **noise** at the workplace.

8.3. Recording and reporting

The **COP** should address the following:

8.3.1. Record keeping system

A record keeping system, which records the **exposure** history of each **HEG,** and the employee's medical surveillance records should be kept as per the relevant legislative requirements (section 12 and 13 of the **MHSA**) and these records should be readily available at the mine.

8.3.2. Occupational medicine reporting

8.3.2.1. Health incident reporting

Reporting of the **NIHL** cases must be done on the **DMRE** 231 reporting form within 30 days of diagnosis.

8.3.2.2. Annual medical reporting

All cases of compensable **NIHL** must be reported on an annual basis to the **DMRE** on the **DMRE** 165 form.

8.4. Linking to medical surveillance records

This **COP** must describe a system in place that addresses the linkage between occupational hygiene measurements and the medical surveillance records as contemplated in section 12(3) of the **MHSA**.

8.5. Compensation

For compensation of **NIHL** refer to instruction 171 (Annexure H: Instruction 171).

PART D: IMPLEMENTATION

1. IMPLEMENTATION PLAN

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

2. COMPLIANCE WITH THE COP

2.1. The employer must institute measures for **monitoring** and ensuring compliance with the **COP**.

3. ACCESS TO THE COP AND RELATED DOCUMENTS

3.1. The employer must ensure that a complete **COP** and related documents are kept readily available at the mine for examination by any affected person.

3.2. A registered trade union with members at the mine or where there is no such union, a health and safety representative at the mine, or, if there is no health and safety representative, an employee representing the employees at the mine, must be provided with a copy on written request to the manager. A register must be kept of such persons or institutions with copies to facilitate updating of such copies.

3.3. The employer must ensure that all employees are fully conversant with those sections of the **COP** relevant to their respective areas of responsibilities.

ANNEXURE A: Mandatory codes
(This annexure forms part of the guideline and must be complied with)

1. MAIN COMMODITY CODE LIST

The main commodity being produced by the mine.

COMMODITY	CODE	COMMODITY	CODE
Asbestos	**AS**	Malmesbury Hornfels	**MH**
Attapulgite	**AP**	Manganese	**MN**
Bentonite	**BT**	Marble	**MB**
Calcrete	**CA**	Mercury	**HG**
Cement	**CE**	Mica	**MC**
Chrome	**CR**	Mineral-pigments	**MP**
Clay	**CY**	Montmorillonite	**MM**
Coal	**CL**	Nepheline	**NP**
Cobalt	**Co**	Nickel	**Ni**
Copper	**CU**	Norite	**NR**
Diamonds	**DI**	Perlite	**PL**
Dolerite	**DR**	Phosphates	**PH**
Dolomite	**DM**	Platinum group metals	**PT**
Dwyka	**DK**	Prospecting (unspecified minerals)	**PR**
Emeralds	**EM**	Pyrophyllite	**PY**
Feldspar	**FD**	Quartzite	**QZ**
Felsite	**FT**	Quartzite dimension stone	**QD**
Fireclay	**FI**	Salt	**NA**
Flintclay	**FY**	Sand	**SA**
Fluorspar	**FS**	Shale	**SH**
Fullers-earth	**FU**	Silica	**SI**
Gas and condensate (MOSSGAS)	**GC**	Silicon-metal	**SM**
Gold	**AU**	Sillimanite	**ST**
Granite	**GT**	Slag	**SG**
Granite dimension stone	**GD**	Slate Dimension Stone	**SD**
Gravel	**GV**	Soil	**SL**
Gypsum	**GS**	Talc	**TC**
Ilmenite	**IL**	Tigers-eye	**TE**
Iron-ore	**FE**	Tin	**SN**
Jasper	**JP**	Titanium	**TN**
Kaolin	**KA**	Uranium	**UR**
Kieselguhr	**KG**	Vanadium	**VA**
Lead	**PB**	Wollastonite	**WS**
Limestone	**LS**	Zinc	**ZN**
Magnesite	**MA**		

2. ACTIVITY AREA CODE LIST

Alphabetical index of the activity areas.

ACTIVITY AREA	CODE
Assay / laboratory	32
Chemical process	27
Concentrating	24
Conventional mining (coal)	01
Continuous miner (coal)	02
Crushing	20
Development (single shift)	09
Development (multi-blast)	10
Dumps / dump recycling	34
Final products	29
Ground handling (conveyor / loco's)	15
Handgot (coal)	04
Heat process	25
Longwall mining (coal)	03
Milling / pulverising	21
Opencast	07
Raise boring / Dry drilling	12
Raw material	19
Refining	28
Rock mining coal	06
Roving plant	30
Roving surface	31
Roving underground	17
Scraper block caving	14
Screening / grading	22
Separation processes	23
Shaft sinking	11
Shafts and services	16
Smelting	26
Stooping / pillar extraction (coal)	05
Stoping	08
Surface Workshops	33
Trackless Mining	13
Underground workshops	18

3. OCCUPATION CODE LIST

Alphabetical index of the occupational codes.

OCCUPATION	CODE
Acclimatisation supervisor	70301
Acclimatisation worker	70302
Accommodation worker (other accommodation) [n.e.c.]	80699
Accommodation worker (residential) [n.e.c.]	80599
Accountant [n.e.c.]	10206
Accounting / financial management	10200
Accounting / financial worker [n.e.c.]	10299
Acid plant official	30402
Acid plant worker	30404
Administration / secretarial management	10900
Administrative officer	10903
Administrative / financial management (multi-disciplinary)	10000
Administrative / financial management [n.e.c.]	10099
Administrative / financial / business worker [n.e.c.]	19999
Advocate / barrister	60601
Agricultural management (multi-disciplinary)	90000
Agricultural management [n.e.c.]	90099
Agricultural worker [n.e.c.]	99999
Air conditioning / refrigeration engineer	40412
Air conditioning / refrigeration mechanic	40413
Air transport management	81100
Air transport officer	81101
Air transport worker [n.e.c.]	81199
Air and water services team leader/supervisor	21507
Air and water services worker	21508
Airport controller	81102
Amalgamator	30110
Ambulance officer	70803
Anaesthetist	70101
Aptitude tester	60106
Aptitude testing supervisor	60105
Aqua-jet operator	21406
Architect	50901
Architectural assistant	50902
Architectural management	50900
Architectural worker [n.e.c.]	50999
Armature winder	40320
Assay / chemistry / laboratory worker [n.e.c.]	50499
Assay technician	50403
Assayer	50401
Assistant driller (ocean)	29909
Assessor	10511
Assopulp worker	35910
Attorney / solicitor / conveyancer	60602

OCCUPATION	CODE
Audio visual tester	70303
Audiologist/speech therapist	70322
Audiometrist	70323
Auditing management	10100
Auditing worker [n.e.c.]	10199
Auditor (computer / systems)	10102
Auditor (internal and external)	10101
Auto electrician	40319
Backfill worker	20805
Baker	35020
Banking officer	11114
Banking / investment management	11100
Banking / investment worker [n.e.c.]	11199
Banksman / onsetter	21304
Bargemaster (ocean)	81202
Barber / hairdresser	80803
Barman	80706
Barrister / advocate	60601
Beer maker	35110
Beerhall supervisor	80705
Bell signaller	21305
Beltsman	30205
Bio-medical engineer	70304
Biokineticist	70102
Blacksmith	40422
Blacksmith: apprentice	40424
Blacksmith: chargehand	40421
Blacksmith: foreman	40420
Blacksmith: operative	40423
Blacksmith: worker [n.e.c.]	40425
Blaster (supervisory)	20306
Blaster: opencast / quarry (non-supervisory)	20502
Blaster: surface works (non-supervisory e.g. smelter)	20503
Blaster: underground metal (non-supervisory)	20501
Blasting worker [n.e.c.]	20599
Boiler attendant	40803
Boilermaker: operative (grade 1)	40450
Boilermaker: operative (aide) (grade 2)	40451
Book binder	36015
Bosun (ocean)	81202
Bookkeeper	10208
Box / orepass controller	21404
Brick maker	36710
Bricklayer	40614
Bricklayer: aide	40617
Builder	40615
Building service worker [n.e.c.]	80499
Building services management	80400

OCCUPATION	CODE
Building worker [n.e.c.]	40618
Building worker: operative	40616
Business analyst (computers)	50503
Business management	10001
Butcher	35010
Buyer / purchaser	10312
Cable joiner	40343
Calcinating worker	30508
Canteen supervisor	80701
Canteen worker	80703
Caretaker / housekeeper	80501
Carpenter	40621
Carpenter and joiner	40622
Carpenter and joiner: apprentice	40623
Carpenter and joiner: chargehand	40620
Carpenter and joiner: foreman	40619
Carpenter: aide	40624
Carpenter: worker [n.e.c.]	40625
Cashier	10209
Caster	30507
Catering management	80700
Cementer (ocean)	21699
Catering worker [n.e.c.]	80799
Cementation driller / injector	21602
Cementation supervisor	21601
Cementation worker [n.e.c.]	21699
Chairlift operator	21307
Chairman (group)	00000
Change house team leader / supervisor	80604
Change house worker	80605
Checker	10395
Chef / cook	80702
Chemical engineer	40701
Chemical engineering management	40700
Chemical engineering worker [n.e.c.]	40799
Chemical process worker [n.e.c.]	30499
Chemist	50402
Chemist technician	50404
Chief executive	00000
Child minder	80802
Chiropodist / podiatrist	70320
Cinema / video operator	60805
Civil engineer	40601
Civil engineering management	40600
Civil engineering technician	40610
Civil engineering worker [n.e.c.]	40699
Civil / building chargehand (other) [n.e.c.]	40651
Civil / building foreman (other) [n.e.c.]	40650

OCCUPATION	CODE
Civil / building tradesman (other) [n.e.c.]	40652
Cleaner (office) / tea maker	80402
Clerk of works	40611
Clerk (accounts / finance)	10295
Clerk (agriculture) [n.e.c.]	99995
Clerk (air transport)	81195
Clerk (architectural)	50995
Clerk (auditing)	10195
Clerk (banking / investment)	11195
Clerk (catering)	80795
Clerk (club)	80695
Clerk (creative arts)	60995
Clerk (economics)	10795
Clerk (engineering planning)	40195
Clerk (engineering)	49995
Clerk (environmental)	51095
Clerk (estate / township)	80395
Clerk (first aid)	70895
Clerk (general e.g. filing) [n.e.c.]	10995
Clerk (geology)	50195
Clerk (hostel / quarters)	80595
Clerk (industrial engineering)	50795
Clerk (industrial relations)	60295
Clerk (insurance)	10595
Clerk (legal)	60695
Clerk (library)	60795
Clerk (marketing / sales)	10895
Clerk (medical)	79995
Clerk (metallurgical plant)	39995
Clerk (mining planning)	20195
Clerk (mining) [n.e.c.]	29995
Clerk (payroll / timekeeping)	10495
Clerk (personnel)	60195
Clerk (printing)	36095
Clerk (property / mining rights)	10695
Clerk (public relations)	60895
Clerk (rail transport)	81095
Clerk (road transport)	80995
Clerk (rock mechanics)	50395
Clerk (safety / loss control)	50895
Clerk (school)	60495
Clerk (security)	80195
Clerk (sports / recreation)	61095
Clerk (statistics)	50695
Clerk (stores)	10395
Clerk (strategic planning)	00295
Clerk (survey)	50295
Clerk (tax)	11295

OCCUPATION	CODE
Clerk (training)	60395
Clerk (welfare)	60595
Clinical assistant	70202
Club management	80600
Club secretary	80601
Club team leader	80602
Club worker	80603
Coal auger operator	20604
Coal cutter operator	20601
Coal plough operator	20605
Coal preparation worker	30211
Coking plant attendant	30509
Collator	36014
Commissionaire (offices)	80401
Commissionaire (residential accommodation)	80502
Company secretary (administrative)	10900
Compressor attendant	40804
Computer operator	50508
Computer programmer	50505
Concentration / flotation worker [n.e.c.]	30399
Consultant (administrative / financial) [n.e.c.]	19996
Consultant (agriculture) [n.e.c.]	99996
Consultant (engineering) [n.e.c.]	49996
Consultant (general management) [n.e.c.]	09996
Consultant (humanities) [n.e.c.]	69996
Consultant (medical) [n.e.c.]	79996
Consultant (metallurgy / beneficiation / manufacturing) [n.e.c.]	39996
Consultant (mining production) [n.e.c.]	29996
Consultant (scientific / technical) [n.e.c.]	59996
Consultant (service occupation) [n.e.c.]	89996
Consultant (tax)	11296
Consulting engineer (engineering support)	40000
Consulting engineer (mining)	20000
Consulting metallurgist	30003
Continuous miner driver	20602
Contractor (outside)	49902
Control room operator	30202
Conveyancer / attorney / solicitor	60602
Conveyer worker [n.e.c.]	20299
Conveyer belt attendant	21202
Conveyer belt team leader / supervisor	21201
Cook / chef	80702
Corporate secretary (administration)	10901
Cost accountant	10205
Cost controller	10205
Crane driver	81301
Crane driver trainer	81398
Creative worker [n.e.c.]	60999

OCCUPATION	CODE
Credit controller	10207
Critical path scheduler	20103
Crop worker	90499
Crossing attendant	81009
Crusher attendant	30207
Cupola man	30505
Cutter	49903
Cyanidation team leader / supervisor	30403
Cyanidation worker	30405
Data base administrator	50513
Data base technician	50514
Data capture supervisor	50510
Data capture typist	50511
Day pusher (ocean)	29908
Deck attendant (ocean)	29910
Deck leader (ocean)	20313
Data controller (computers)	50509
Dental assistant	70504
Dental mechanic	70503
Dental specialist (e.g. oral pathologist) [n.e.c.]	70499
Dental surgeon / dentist	70401
Dental therapist	70502
Dental worker [n.e.c.]	70599
Dermatologist	70103
Designer (engineering)	40102
Detective	80104
Developer	20303
Development management (hardware)	50501
Development management (software)	50502
Development team leader / supervisor	20310
Development team worker	20701
Diamond drill team leader / supervisor	50111
Diamond drill worker	50112
Diamond driller	50110
Diecaster	40501
Diesel mechanic	40477
Diesel mechanic: apprentice	40478
Diesel mechanic: chargehand	40476
Diesel mechanic: foreman	40475
Dietician	70305
Diplomatic / political liaison officer	60802
Diver (ocean)	29911
Disinfestation worker	40905
Dog handler	80105
Domestic servant	80801
Dragline operator	21102
Dragline supervisor	21101
Drains cleaner	29906

OCCUPATION	CODE
Draughting technician	49994
Draughtsperson (architectural)	50994
Draughtsperson (chemical engineering)	40794
Draughtsperson (civil engineering)	40694
Draughtsperson (electrical engineering)	40394
Draughtsperson (geological)	50194
Draughtsperson (mechanical engineering)	40594
Draughtsperson (mining production) [n.e.c.]	29994
Draughtsperson [n.e.c.]	49994
Draughtsperson (survey)	50294
Draughtsperson (technical services)	59994
Drill rig operator (jumbo)	20401
Drill sharpener	40528
Driller: hand percussion / jackhammer	20402
Driller: hand (coal)	20403
Driller: opencast / large diameter	20404
Drilling worker [n.e.c.]	20499
Drillsmith	40527
Driver: ambulance (code 08)	80908
Driver: bulldozer	21103
Driver: forklift	80905
Driver: haul truck (underground and opencast)	21109
Driver: heavy articulated motor vehicle (code 13)	80911
Driver: heavy motor vehicle (e.g. bus / ambulance code 10)	80909
Driver: light motor vehicle /car (code 08)	80907
Driver: mobile industrial / agricultural equipment (code 07)	80906
Driver: motorcycle (code 01-04)	80903
Driver: tractor (code 05)	80904
Driving instructor	80998
Dryerman	30406
Dump team leader / supervisor	30702
Dump worker	30703
Dumpsman	30701
Duplicator	10907
Ear, nose and throat specialist	70104
Economics assistant	10703
Economics management	10700
Economics worker [n.e.c.]	10799
Economist [n.e.c.]	10702
Economy controller	10205
Editor	60901
Educational management	60400
Educational / school worker [n.e.c.]	60499
EEG technician	70306
Electrical chargehand (other) [n.e.c.]	40341
Electrical engineer	40301
Electrical engineering management	40300
Electrical engineering worker [n.e.c.]	40399

OCCUPATION	CODE
Electrical foreman (other) [n.e.c.]	40340
Electrical technician	40310
Electrical tradesman (other) [n.e.c.]	40342
Electrician	40314
Electrician: aide	40317
Electrician: apprentice	40315
Electrician: chargehand	40313
Electrician: foreman	40312
Electrician: underground section	40316
Electrician: worker [n.e.c.]	40318
Electricity generator worker	40802
Electro mechanic / millwright / minewright	40437
Electronic technician	40311
Employee assistance programme management	60500
Encoder	19910
Energy systems management	40800
Energy systems officer	40805
Energy systems team leader / supervisor	40801
Energy systems worker [n.e.c.]	40899
Engineer [n.e.c.]	40201
Engineering assistant [n.e.c.]	40205
Engineering foreman [n.e.c.]	40004
Engineering inspector	40202
Engineering management (multi-disciplinary)	40001
Engineering management [n.e.c.]	40099
Engineering team leader [n.e.c.]	49901
Engineering technical worker [n.e.c.]	40299
Engineering technician [n.e.c.]	40203
Entertainer	60905
Environmental assistant	51004
Environmental construction supervisor	51007
Environmental construction worker	51008
Environmental engineer	51001
Environmental engineering management	51000
Environmental observer	51005
Environmental officer	51003
Environmental superintendent	51002
Environmental worker [n.e.c.]	51099
Equipper	21504
Estate / township management	80300
Estate / township officer	80301
Estate / township team leader / supervisor	80302
Estate / township worker [n.e.c.]	80399
Estimator / calculator	40104
Executive director [n.e.c.]	00000
Explosives issuer	10317
Facilities management (computers)	50506
Fan attendant	40344

OCCUPATION	CODE
Farm manager	90001
Filing / records officer	10904
Filter operator / worker	30302
Filter team leader / supervisor	30301
Financial accountant	10204
Financial analyst	10201
Financial economist	10701
Financial engineer	10202
Financial/accounting management	10200
Financial/admin management (multi-disciplinary)	10000
Firefighting/rescue officer	80202
Firefighting/rescue team leader/supervisor	80203
Firefighting/rescue trainer	80298
Firefighting/rescue worker [n.e.c.]	80299
Fireman / stoker	81005
Firemaster	80201
First aid attendant	70802
First aid management / medical station superintendent	70800
First aid team leader / supervisor	70801
First aid trainer	70898
First aid training superintendent	70898
First aid worker [n.e.c.]	70899
Fitter and turner	40428
Fitter and turner: apprentice	40429
Fitter and turner: chargehand	40427
Fitter and turner: foreman	40426
Fitter (including machining): apprentice	40433
Fitter (including machining)	40432
Fitter (including machining): chargehand	40431
Fitter (including machining): foreman	40430
Fitter: operative (grade 1)	40434
Fitter: operative aide (grade 2)	40435
Fitter: worker [n.e.c.]	40436
Forester	90301
Forestry engineer	90300
Forestry worker	90399
Forger	40502
Founder	40505
Furnace worker [n.e.c.]	30599
Game ranger	90501
Ganger / plate / tracklayer (main line)	40656
Garage mechanic: aide	40480
Garage serviceman	40481
Garage worker [n.e.c.]	40482
Garden supervisor / groundsman	90102
Garden worker	90199
General engineering supervisor	40002
General engineering worker [n.e.c.]	49999

OCCUPATIONAL HEALTH PROGRAMME (OCCUPATIONAL HYGIENE AND MEDICAL SURVEILLANCE) ON THERMAL STRESS

OCCUPATION	CODE
General management [n.e.c.]	00199
General manager (company)	00102
General manager (mine)	00101
General miner	20305
General practitioner	70201
Geochemist	50103
Geological management	50100
Geological observer / field assistant	50109
Geological worker [n.e.c.]	50199
Geologist	50101
Geology technician	50108
Geophysicist	50102
Grab operator	21401
Grade officer	50408
Graphic artist	60904
Grinderman / pulveriser	30210
Groundsman / garden supervisor	90102
Guest house / quarters management	80500
Guillotine operator	36013
Gynaecologist	70105
Hairdresser / barber	80803
Handyman (maintenance)	40654
Handyman (mining)	21504
Haulage team leader/supervisor	21001
Haulage / underground rail transport worker [n.e.c.]	21099
Health / food inspector	70307
Herdsman / stable hand	90502
Hoist driver	21302
Hoisting worker [n.e.c.]	21399
Horticulturist	90101
Hospital cleaner	79901
Hospital secretary	10902
Hospital superintendent	70002
Hospital worker / orderly	70324
Hostel management	80505
Hostel official	80506
Hostel team leader / supervisor	80507
Housekeeper / caretaker	80501
Humanities management (multi-disciplinary)	60000
Humanities management [n.e.c.]	60099
Humanities worker [n.e.c.]	69999
Hydraulic prop team leader / supervisor	20801
Hydraulic prop worker	20802
Hydraulic technician	40411
Hygiene services worker [n.e.c.]	40999
Induna / tribal representative	60203
Industrial engineer	50701
Industrial engineering management	50700

OCCUPATION	CODE
Industrial engineering officer	50704
Industrial engineering technician	50702
Industrial engineering worker [n.e.c.]	50799
Industrial physician	70106
Industrial relations assistant	60202
Industrial relations management	60200
Industrial relations practitioner	60201
Industrial relations worker [n.e.c.]	60299
Info services / computer worker [n.e.c.]	50599
Information centre management (computers)	50516
Information services management	50500
Instrument engineer	40321
Instrument mechanician (industrial)	40325
Instrument mechanician apprentice (industrial)	40326
Instrument mechanician chargehand (industrial)	40324
Instrument mechanician foreman (industrial)	40323
Instrument technician	40322
Insurance adviser	10596
Insurance management	10500
Insurance worker [n.e.c.]	10599
Internist / specialist physician	70107
Inventory controller	10315
Irrigation engineer	90400
Issuer (explosives)	10317
Issuer (stores, non-explosive)	10316
Journalist / writer	60902
Junior engineer (civil engineering)	40602
Junior engineer (electrical engineering)	40302
Junior engineer (mechanical engineering)	40402
Junior engineer [n.e.c.]	40207
Kennel worker	90503
Kilnman	30504
Kitchen worker	80703
Laboratory assistant	50406
Laboratory manager/superintendent	50400
Laboratory technician	50405
Labour controller	60103
Ladleman	30506
Lamp room team leader /supervisor	40346
Lamp room worker	40347
Lampsman	40345
Land rehabilitation engineer	90200
Land rehabilitation supervisor	90201
Land rehabilitation worker	90299
Lasher / loader [n.e.c.]	29905
Laundry supervisor	80503
Laundry worker	80504
Leaching worker	30407

OCCUPATION	CODE
Learner miner	20309
Learner official (assay / chemistry)	50409
Learner official (electrical engineering)	40303
Learner official (engineering) [n.e.c.]	40206
Learner official (geology)	50113
Learner official (mechanical engineering)	40403
Learner official (metallurgy)	30105
Learner official (mining)	20202
Learner operative	40208
Legal assistant	60603
Legal management	60600
Legal worker [n.e.c.]	60699
Librarian	60701
Library assistant	60702
Library management	60700
Library worker [n.e.c.]	60799
Lift operator	21306
Liquor outlet supervisor	80705
Lithographer	36010
Livestock worker [n.e.c.]	90599
Load haul dump driver	21106
Loader driver (rail)	21004
Loader driver (trackless)	21104
Loco driver (main line - SPOORNET)	81003
Loco driver (not main line)	81004
Loco driver (underground)	21002
Loco guard (underground)	21003
Longwall sheerer operator	20603
Magazine master	10317
Magnetometer specialist	50106
Maintenance supervisor	40653
Management accountant	10203
Marketing assistant	10812
Marketing officer	10810
Marketing and sales management	10800
Marketing / sales worker [n.e.c.]	10899
Mason	40626
Mason aide	40627
Masseur / masseuse	70308
Matron / nursing services management	70600
Mechanic (ocean)	40414
Maxillo-facial and oral surgeon	70402
Mechanical charge hand	40521
Mechanical engineer	40401
Mechanical engineering management	40400
Mechanical engineering worker [n.e.c.]	40599
Mechanical foreman (other) [n.e.c.]	40520
Mechanical rockbreaking worker [n.e.c.]	20699

OCCUPATION	CODE
Mechanical technician	40410
Mechanical tradesman (other) [n.e.c.]	40522
Media technician	60908
Medical advisor	70001
Medical labourer	79901
Medical officer	70201
Medical orthoptist / prosthetist	70309
Medical physicist	70310
Medical specialist [n.e.c.]	70199
Medical station superintendent/first aid management	70800
Medical technician	70311
Medical technologist	70312
Medical worker [n.e.c.]	79999
Medical / health care management (multi-disciplinary)	70000
Medical / health care management [n.e.c.]	70099
Meshing and lacing team leader / supervisor	20803
Meshing and lacing worker	20804
Messenger / postal worker	11010
Metallurgical official [n.e.c.]	30103
Metallurgical worker [n.e.c.]	30199
Metallurgical / plant management	30000
Metallurgical / plant superintendent	30001
Metallurgical / plant supervisor	30002
Metallurgist	30101
Metallurgy technician (extractive)	30102
Microscopist	51006
Milling worker	30208
Millwright / electro mechanic / minewright	40437
Mine construction team leader / supervisor [n.e.c.]	21510
Mine construction worker [n.e.c.]	21599
Mine manager	00101
Mine overseer	20002
Mine planning / valuation engineer	20101
Mine police / security guard	80103
Mine production management [n.e.c.]	20099
Mine production supervisor [n.e.c.]	20399
Mine production worker [n.e.c.]	29999
Mine secretary (administration)	10900
Mine transport worker [n.e.c.]	21499
Miner (general)	20305
Mineralogist	50104
Miner's assistant (cheesa)	20504
Mining engineer [n.e.c.]	20201
Mining technical worker [n.e.c.]	20299
Mining technician [n.e.c.]	20210
Mixed farming worker [n.e.c.]	90699
Model maker	40103
Model maker (survey)	50205

OCCUPATION	CODE
Money market dealer	11113
Monorail winch operator	21308
Monorope winch operator	21309
Motorman (ocean)	40543
Mortuary attendant	70313
Motor mechanic	40473
Motor mechanic apprentice	40474
Motor mechanic chargehand	40472
Motor mechanic foreman	40471
Motor / diesel mechanic operative	40479
Moulder	40504
Multi task worker (underground production)	20704
Multi task worker (opencast production)	20705
Musician	60905
Network technician (computers)	50515
Neurologist	70108
Night pusher (ocean)	29908
Neurosurgeon	70109
Night shift cleaner	20308
Nurse (charge / senior sister)	70601
Nurse (enrolled / staff)	70603
Nurse (registered all categories) [n.e.c.]	70602
Nursing assistant	70604
Nursing instructor	70698
Nursing services management/matron	70600
Nursing worker [n.e.c.]	70699
Occupational therapist	70314
Occupational health physician	70120
Occupational hygienist	70121
Offshore installation manager (ocean)	00101
Onsetter / banksman	21304
Operations research officer	50703
Operations / network operator (computers)	50507
Ophthalmologist	70110
Optical dispenser	70316
Optician / optometrist	70315
Oral hygienist	70501
Orderly / hospital worker	70324
Orepass / box controller	21404
Orthodontist	70403
Orthopaedic surgeon	70111
Orthoptist	70317
Paediatrician	70113
Painter and decorator / maintenance hand	40637
Painter and decorator (worker) [n.e.c.]	40638
Panel beater	40470
Paper maker	35911
Paper manufacturing management	35900

OCCUPATION	CODE
Paper tester	35912
Pathologist (medical)	70112
Patternmaker	40503
Paver	40629
Paymaster	10404
Payroll administrator	10402
Payroll controller	10401
Payroll management	10400
Payroll worker [n.e.c.]	10499
PC programmer / product specialist	50517
Performing artist	60905
Periodontist	70404
Personal assistan t /secretary	10905
Personal care worker [n.e.c.]	80899
Personnel assistant / masiza	60102
Personnel management	60100
Personnel officer / practitioner	60101
Personnel worker [n.e.c.]	60199
Pharmaceutical worker [n.e.c.]	70799
Pharmacist	70701
Photographer	60906
Physiologist	70318
Physiotherapist	70319
Pilot (aircraft)	81103
Pipes and tracks team leader / supervisor	21505
Pipes and tracks worker	21506
Pit worker	20703
Planned maintenance foreman	40003
Planning management (engineering)	40100
Planning management (mining)	20100
Planning observer	20104
Planning officer	20102
Planning officer (engineering)	40101
Planning worker (engineering) [n.e.c.]	40199
Planning worker (mining) [n.e.c.]	20199
Plant team leader / supervisor	30204
Plant worker [n.e.c.]	30299
Plant / reduction official	30201
Plasterer	40628
Plastic surgeon	70114
Plater	40448
Plater / boilermaker	40447
Plater / boilermaker apprentice	40449
Plater / boilermaker chargehand	40446
Plater / boilermaker foreman	40445
Plater / boilermaker worker [n.e.c.]	40452
Plater / welder	40455
Plater / welder apprentice	40457

OCCUPATION	CODE
Plater / welder chargehand	40454
Plater / welder foreman	40453
Plater / welder worker [n.e.c.]	40458
Plate / track layer/ganger (main line)	40656
Play school supervisor	60404
Plumber	40632
Plumber aide	40635
Plumber apprentice	40633
Plumber chargehand	40631
Plumber foreman	40630
Plumber operative	40634
Plumber worker [n.e.c.]	40636
Podiatrist/chiropodist	70320
Pool gang worker	09801
Postal worker / messenger	11010
Power hammer operator	40530
Press operator	40529
Pre-primary school assistant	60405
Printer [n.e.c.]	36011
Printing machine operator	36012
Printing management	36000
Printing supervisor	36001
Printing worker [n.e.c.]	36099
Process controller	30203
Producer / director (creative arts)	60900
Production / section / underground manager	20001
Productivity officer	50705
Project manager (administration / financial) [n.e.c.]	19992
Project manager / officer (agriculture) [n.e.c.]	99992
Project manager / officer (engineering) [n.e.c.]	49992
Project manager / officer (general management) [n.e.c.]	09992
Project manager / officer (humanities) [n.e.c.]	69992
Project manager/officer (medical/health) [n.e.c.]	79992
Project manager/officer (mining) [n.e.c.]	29992
Project manager / officer (reduction / beneficiation / manufacturing)	39992
Project manager / officer (scientific / technical) [n.e.c.]	59992
Project manager / officer (services) [n.e.c.]	89992
Property broker	10601
Property / mining rights management	10600
Property / mining rights officer	10602
Property / mining rights worker [n.e.c.]	10699
Prospector	50107
Prosthetist / Orthotist	70309
Prosthodontist	70405
Psychiatrist	70115
Psychologist (clinical)	60501
Psychologist (industrial)	60104
Public relations assistant	60803

OCCUPATION	CODE
Public relations management	60800
Public relations officer	60801
Public relations worker [n.e.c.]	60899
Pulveriser / grinderman	30210
Pump team leader / supervisor	40531
Pump worker	40532
Pupil metallurgist	30104
Purchaser / buyer	10312
Purchasing / stores management	10300
Quantity surveyor	40613
Quarryman	20307
Radio / medic (ocean)	79999
Radio mechanician	40327
Radio operator	11012
Radiographer	70321
Radiologist	70116
Rail transport management	81000
Rail transport officer	81001
Rail transport team leader	81002
Rail transport worker [n.e.c.]	81099
Raise / tunnel borer operator	20607
Raise / tunnel borer supervisor	20606
Receiver (stores)	10313
Receptionist/typist/word processor operator	10906
Records / filing officer	10904
Reduction / beneficiation / manufacturing management [n.e.c.]	30099
Reduction / beneficiation / manufacturing worker [n.e.c.]	39999
Reduction / plant official	30201
Reeler	21403
Refiner	30601
Refining worker [n.e.c.]	30699
Refrigeration plant operator	40415
Refrigeration plant team leader / supervisor	40414
Refrigeration / air conditioning engineer	40412
Refrigeration / air conditioning mechanic	40413
Refuse collector	40906
Registrar (medical)	70202
Rescue training service management	80200
Rescue / firefighting officer	80202
Rescue / firefighting team leader/supervisor	80203
Rescue / firefighting trainer	80298
Rescue / firefighting worker [n.e.c.]	80299
Researcher (agriculture) [n.e.c.]	99997
Researcher (engineering) [n.e.c.]	49997
Researcher (general management) [n.e.c.]	09997
Researcher (humanities) [n.e.c.]	69997
Researcher (medical) [n.e.c.]	79997
Researcher (metallurgy / beneficiation / manufacturing) [n.e.c.]	39997

OCCUPATION	CODE
Researcher (mining production) [n.e.c.]	29997
Researcher (rock mechanics)	50397
Researcher (scientific / technical) [n.e.c.]	59997
Researcher (service occupation) [n.e.c.]	89997
Rigger and ropeman	40508
Rigger and ropeman apprentice	40509
Rigger and ropeman chargehand	40507
Rigger and ropeman foreman	40506
Rigger and ropeman worker [n.e.c.]	40511
Rigger aide	40510
Road builder	40655
Road transport management	80900
Road transport officer	80901
Road transport team leader	80902
Road transport worker [n.e.c.]	80999
Rock breaking worker [n.e.c.]	20799
Rock mechanics engineer	50301
Rock mechanics management	50300
Rock mechanics officer	50302
Rock mechanics worker [n.e.c.]	50399
Rock support worker [n.e.c.]	20899
Roof bolt machine operator	20806
Roof bolt worker	20807
Roughneck (ocean)	29909
Roustabout (ocean)	81201
Rubber reliner	40523
Safety / loss control auditor	50802
Safety / loss control management	50800
Safety / loss control observer assistant	50803
Safety / loss control officer	50801
Safety / loss control worker [n.e.c.]	50899
Sales representative	10811
Salvage yard aide	10319
Salvage and reclamation worker (surface)	10320
Salvage and reclamation worker (underground)	29907
Sample worker	50204
Sampler	50203
Sanitation worker	40904
Saw doctor	40540
Saw sharpener	40542
Sawmill mechanic	40541
Sawyer	35710
School principal	60401
Scientific / technical management (multi-disciplinary)	50000
Scientific / technical management [n.e.c.]	50099
Scientific / technical worker [n.e.c.]	59999
Scraper winch bell operator	20902
Scraper winch driver	20901

OCCUPATION	CODE
Scraping worker [n.e.c.]	20999
Screensman	30209
Sea transport worker [n.e.c.]	81299
Secretarial / administrative worker [n.e.c.]	10999
Secretarial / administration management	10900
Secretary / personal assistant	10905
Section leader	29901
Section / production/underground manager	20001
Securities officer	11112
Security guard / mine police	80103
Security inspector / officer	80101
Security management	80100
Security supervisor (e.g. sergeant)	80102
Security worker [n.e.c.]	80199
Sedimentologist	50105
Seismic network technician	50306
Seismologist	50305
Self-propelled machine driver [n.e.c.]	21107
Service worker [n.e.c.]	89999
Services management (multi-disciplinary)	80000
Services management [n.e.c.]	80099
Sewage plant operator	40903
Shaft foreman	20301
Shaft sinker	21501
Shaft timberman worker	21503
Shaft timberman/timberman	21502
Shakerhand (ocean)	29909
Share transfer officer	11111
Sheetmetal worker	40459
Shift boss	20302
Shot blast operator	40526
Shotcrete worker	20804
Shovel operator	21105
Shunter	81007
Shuttlecar driver	21108
Signaller	81008
Signwriter	40639
Skipman	21303
Slimes dam team leader / supervisor	30704
Slimes dam worker	30705
Slimes dam / dump worker [n.e.c.]	30799
Smelter	30501
Smelter team leader/supervisor	30502
Smelter worker	30503
Social worker	60502
Solicitor/attorney/conveyancer	60602
Sorter	30206
Spannerman / driller's assistant	20405

OCCUPATION	CODE
Spectrographer	50407
Speech therapist/audiologist	70322
Sports worker [n.e.c.]	61099
Sports / recreation assistant	61002
Sports / recreation management	61000
Sports / recreation officer	61001
Stable hand / herdsman	90502
Stacker operator	21402
Stage worker	21509
Standards officer	10311
Statistical officer	50602
Statistical worker [n.e.c.]	50699
Statistician	50601
Statistics management	50600
Stevedore	81201
Stockbroker	11110
Stoker / fireman	81005
Stone packer	29904
Stope team leader / supervisor	20311
Stope team worker	20702
Stoper	20304
Storekeeper	10314
Stores controller	10310
Stores issuer (non-explosive)	10316
Stores receiver	10313
Stores worker [n.e.c.]	10399
Stores / purchasing management	10300
Strata control observer	50304
Strata control officer	50303
Strategic planning analyst	00201
Strategic planning management	00200
Strategic planning worker [n.e.c.]	00299
Stripper operator	30408
Student (administrative / financial) [n.e.c.]	19993
Student (agriculture) [n.e.c.]	99993
Student (engineering) [n.e.c.]	49993
Student (geology)	50193
Student (humanities) [n.e.c.]	69993
Student (medical)	79993
Student (metallurgy / beneficiation / manufacturing) [n.e.c.]	39993
Student (mining production) [n.e.c.]	29993
Student (scientific / technical) [n.e.c.]	59993
Student (service occupation) [n.e.c.]	89993
Supervisor's assistant (underground)	29902
Supplementary medical worker [n.e.c.]	70399
Surgeon (general)	70117
Survey management	50200
Survey worker [n.e.c.]	50299

OCCUPATION	CODE
Surveyor (land)	50201
Surveyor (mine)	50202
Sweeper / vamper	29903
Systems accountant	10203
Systems analyst	50504
Systems/network programmer	50512
Tailor	34510
Tea maker / office cleaner	80402
Teacher (nursery education)	60404
Teacher (primary education)	60403
Teacher (secondary education)	60402
Team leader / supervisor (other mining production work)	20312
Technical assistant engineering [n.e.c.]	40204
Technical assistant mining [n.e.c.]	20211
Technical services management	50001
Technical services department (TSD) officer [n.e.c.]	59901
Telecommunications worker [n.e.c.]	11099
Telephonist	11011
Television cameraman	60907
Thoracic surgeon	70118
Timber, pulp and paper worker [n.e.c.]	35999
Timekeeper	10403
Tip team leader / supervisor	21405
Tip worker	21406
Toolmaker	40512
Toolpusher (ocean)	20312
Tour guide	60804
Town planner	40612
Tracer [n.e.c.]	49994
Trackless machine team leader / supervisor	21101
Trackless machine trainer (e.g. dragline)	21198
Trackless machine worker [n.e.c.]	21199
Track/plate layer / ganger (main line)	40656
Train guard	81006
Trainer (administrative / financial) [n.e.c.]	19998
Trainer (agriculture) [n.e.c.]	99998
Trainer (chemical engineering)	40798
Trainer (civil engineering)	40698
Trainer (computers)	50598
Trainer (crane driving)	81398
Trainer (electrical engineering)	40398
Trainer (firefighting / rescue)	80298
Trainer (first aid)	70898
Trainer (general engineering) [n.e.c.]	49998
Trainer (general management) [n.e.c.]	09998
Trainer (humanities) [n.e.c.]	69998
Trainer (mechanical engineering)	40598
Trainer (medical) [n.e.c.]	79998

OCCUPATION	CODE
Trainer (metallurgy / beneficiation / manufacturing) [n.e.c.]	39998
Trainer (mining production) [n.e.c.]	29998
Trainer (nursing)	70698
Trainer (road driving)	80998
Trainer (safety / loss control)	50898
Trainer (scientific / technical) [n.e.c.]	59998
Trainer (security)	80198
Trainer (service occupation) [n.e.c.]	89998
Trainer / instructor [n.e.c.]	60398
Training assistant	60302
Training management	60300
Training officer [n.e.c.]	60301
Training worker [n.e.c.]	60399
Translator	60903
Transport worker [n.e.c.]	81399
Tribal representative/induna	60203
Typist / word processor operator / receptionist	10906
Unclassified occupation (unknown / no specific skill)	09999
Typist / word processor operator / receptionist	10906
Underground / production/section manager	20001
Uranium plant official	30401
Urologist	70119
User support (computers)	50518
Valuator	10510
Waiter / waitress	80704
Water, effluent and sanitation management	40900
Water, effluent and sanitation officer	40907
Water, effluent and sanitation team leader / supervisor	40901
Water treatment operator	40902
Weighbridge attendant	10395
Welder	40456
Welfare assistant	60504
Welfare officer	60503
Welfare worker [n.e.c.]	60599
Winch operator \ driver	40526
Winch transporter team leader	40525
Winch transporter / erector	40524
Winding engine driver (licensed)	21301
Wireline operators (ocean)	20406
Word processor operator / typist / receptionist	10906
Work study observer/assistant	50707
Work study officer	50706
Wrapper	35913
Writer / journalist	60902
Yard supervisor	10318
Yard worker [n.e.c.]	10321

ANNEXURE B: **HEG** determination - example of statistical approach
(For information only)

1. INTORODUCTORY INFORMATION

In statistics, a **CI** is a particular kind of interval estimate of a population parameter. Instead of estimating the parameter by a single value, an interval likely to include the parameter is given. Thus, **CIs** are used to indicate the reliability of an estimate. How likely the interval is to contain the parameter is determined by the confidence level or confidence coefficient. Increasing the desired confidence level will widen the confidence interval.

A **CI** is always qualified by a particular confidence level, usually expressed as a percentage. The end points of the **CI** are referred to as confidence limits.

STEP 1

Action to be performed:

a) Capture sampling data in Microsoft Excel.

b) Calculate the A-weighting network frequency **RMS** sound pressure in pascals, for each sound pressure level measurement in **dBA**, by making use of the formula below:

$$L_{\mathrm{pA}} = 10 \log \left(\frac{p_A}{p_0}\right)^2$$

Formulae in Microsoft Excel:

=POWER(10,(A2/20))*0.00002

Where:

- "A4"= cell were sound pressure level (**dBA**) data is entered in Microsoft Excel spread sheet

c) Determine the descriptive statistics for the data by utilising Microsoft Excel ***Analysis ToolPak***.

To install the ***Analysis ToolPak*** (early versions of Microsoft Excel):

a) On the ***Tools*** menu, select ***Add-Ins***.

b) If the ***Analysis ToolPak*** is not listed in the ***Add-Ins*** dialog box, click ***Browse*** and locate the drive, folder name and file name for the ***Analysis ToolPak Add-Ins*** (Analys32.xll), usually located in the ***Library/Analysis folder***, or run the ***Setup-programme*** if it is not installed.

c) Select the ***Analysis ToolPak*** check box.

To install the ***Analysis ToolPak*** (later versions of Microsoft Excel):

a) On the ***File*** menu, select ***Options*** and then click on ***Add-Ins***.

b) If the ***Analysis ToolPak*** is not listed in the ***Add-Ins*** dialog box, select the ***Add-ins*** option from the ***Manage*** field and click on the ***Go*** button. Select the ***Analysis ToolPak*** and ***Analysis ToolPak - VBA*** and click the ***OK*** button. If the ***Analysis ToolPak*** and ***Analysis ToolPak - VBA*** are not listed, locate the drive, folder name, and file name for the ***Analysis ToolPak Add-Ins*** (Analys32.xll), usually located in the ***Library/Analysis folder***, or run the ***Setup-programme*** if it is not installed.

c) Select the ***Analysis ToolPak*** check box.

How to use the ***Analysis ToolPak***:

a) Before using the analysis tool, you must first arrange the data you want to analyse in one column (e.g. A1 to A40 - if you have 40 values that you want to analyse).

b) On the ***Tools*** menu, click ***Data Analysis***.

c) In the ***Analysis Tools*** box, select the ***Descriptive Statistics*** tool.

d) Enter the input range (e.g. A1 to A40).

e) Select the ***Grouped by Columns*** option.

f) Select the output range (e.g. B1 to B40).

g) Select the ***Summary Statistics*** option.

h) Select the ***Confidence Level of Mean*** option and enter this value as being 95%.

i) Select ***OK***.

Expected result:

EXAMPLE OF DATA ENTERED INTO MICROSOFT EXCEL	
SOUND PRESSURE LEVEL DATA (dBA)	**CALCULATED RMS SOUND PRESSURE (Pa)**
82.5	0.266704286
82.6	0.269792577
82.7	0.272916627
82.9	0.279273672
83.2	0.289087954
83.1	0.285778792

EXPECTED RESULT AFTER COMPLETING ACTIONS AS INDICATED UNDER STEP 1	
DESCRIPTIVE STATISTICS	
Mean	0.35142
Standard error	0.020882
Median	0.33271
Mode	0.289088
SD	0.083528
Sample variance	0.006977

83.2	0.289087954
83.8	0.309763324
85	0.355655882
85.1	0.359774183
85.2	0.363940172
85.3	0.413076031
85.7	0.432543705

Kurtosis	-0.27375
Skewness	0.85202
Range	0.265441
Minimum	0.266704
Maximum	0.532145
Sum	5.622721
Count	16
Confidence level (95.0%)	1.165475

STEP 2

Action to be performed:

From the descriptive statistical analysis calculate the following:

a) 2**SD** = 2 x **SD** e.g. 2 x 0.0835 = 0.167

b) Mean - 2**SD** = Mean - 2**SD** e.g. 0.351 – 0.167 = 0.184

c) Mean + 2**SD** = Mean + 2**SD** e.g. 0.351 + 0.167 = 0.518

d) 90th **percentile** value by utilizing the following Microsoft Excel formula:

= ***PERCENTILE*** *(A1:A40,0.9) = 0.459 (for the data used in this example)*

Where:

- "A1:A40" = Range were data is entered in Microsoft Excel spread sheet.
- "0.9" = The **percentile** to be calculated, in this case the 90th **percentile**.

Convert the calculated **RMS** sound pressure (Pa) back to sound pressure level (**dBA**) by utilizing the following Microsoft Excel formula:

=(10*LOG(POWER(SUM(I4/0.00002),2)))

Where:

- "I4" = cell were **RMS** sound pressure (Pa) data is entered in Microsoft Excel spread sheet

CALCULATIONS	
Mean	= 84.90
Mean - 2**SD**	= 79.30
Mean + 2**SD**	= 88.27
90th **percentile**	= 87.21

Interpretation:

From the calculation performed above it can already be estimated that this **HEG** in NOT statistically correct defined as:

- The mean value (84.90) falls within the "C category" and the 90th **percentile** value (87.21) falls within the "B category". For a **HEG** to be statistically correctly defined, the mean value and 90th **percentile** value will almost always fall within the same classification band.

STEP 3

Action to be performed:

Determine if 95% of the samples taken falls within 2**SD** form the mean value.

Example:

a) 95% of the samples must be between "Mean - 2**SD**" (79.30) and "Mean + 2**SD**" (88.27)

b) From the data, zero samples are smaller than "Mean - 2**SD**" and one sample (88.5) is larger than "Mean + 2**SD**".

Interpretation:

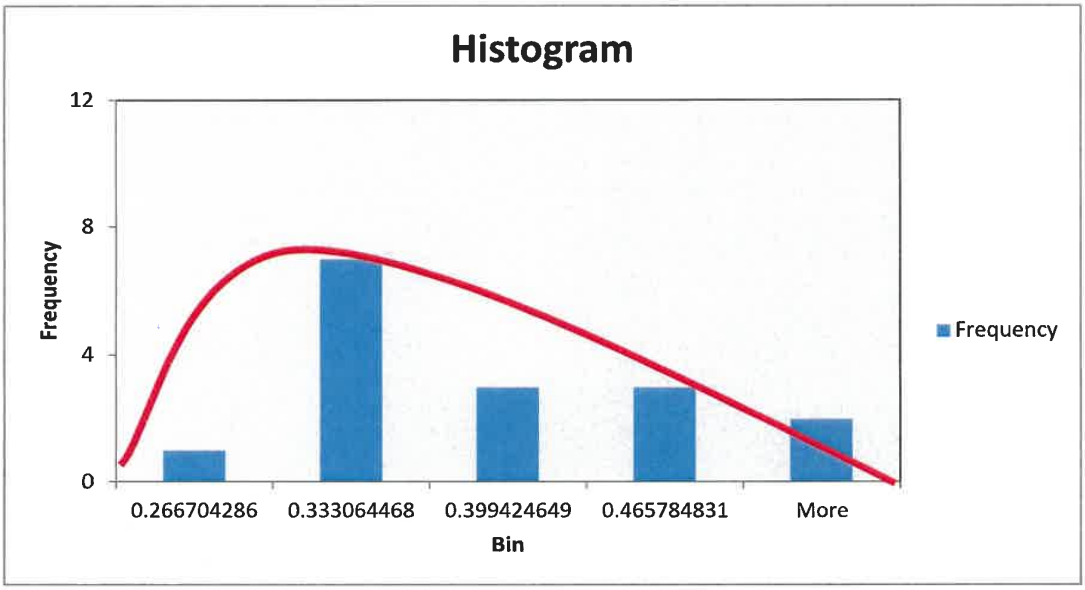
One out of 16 samples falls outside the 2**SD** form the mean value, which represents 6.25% of the sample group (i.e. 1/16 x 100 = 6.25%). This is more than the allowable 5% and therefore the **HEG** cannot be seen as statistically correctly defined.

STEP 4

Action to be performed:

Draw a histogram to graphically indicate the data.

Expected result:



Interpretation:

From the histogram it is also clear that the **HEG** is NOT statistically correctly defined (no bell curve). Only two things can be done to correct this situation:

a) Obtain more samples to determine the correct distribution of samples within the **HEG**. This is currently being forced by the legislated sampling strategy as the "logarithmic average" value being reported, (for an **OEL** of 85 in this example) falls within a "B category" (5% sampled over 12 months) but the 90th **percentile** value is reported as an "A category" thus forcing more samples to be taken (5% over 6 months).

b) Conduct an investigation to determine if more than one **HEG** is being represented by the data.

STEP 5

Action to be performed:

Conduct an investigation to determine if more than one **HEG** is being represented by the data. This can be done by investigation and following the methodology as explained up to this point (for example):

- After investigation, the **HEG** was divided into two separate **HEGs** (electrical workshop **HEG** and mechanical workshop **HEG**).

- The data collected was then allocated to the two **HEG**'s and the statistical analysis revealed the following:

Electrical workshop noise measurement results:

SOUND PRESSURE LEVEL DATA (dBA)	CALCULATED RMS SOUND PRESSURE (Pa)
82.5	0.266704286
82.6	0.269792577
82.7	0.272916627
82.9	0.279273672
83.2	0.289087954
83.1	0.285778792
83.2	0.289087954
83.8	0.309763324

DESCRIPTIVE STATISTICS	
Mean	0.282801
Standard error	0.004916
Median	0.282526
Mode	0.289088
SD	0.013905
Sample variance	0.000193
Kurtosis	0.944465
Skewness	0.902975
Range	0.043059
Minimum	0.266704
Maximum	0.309763
Sum	2.262405
Count	8
Confidence level (95.0%)	0.687951

Calculations from the descriptive statistical analysis:

CALCULATIONS	
Mean	= 0.283
2 x **SD**	= 0.028
Mean - 2**SD**	= 0.255
Mean + 2**SD**	= 0.311
90th **percentile**	= 0.295

Convert the calculated **RMS** sound pressure (Pa) back to sound pressure level (**dBA**):

CALCULATIONS	
Mean	= 83.01
Mean - 2**SD**	= 82.11
Mean + 2**SD**	= 83.82
90th **percentile**	= 83.38

Action to be performed:

From the calculation performed above it can already be estimated that this **HEG** is statistically correct defined as:

a) The mean value (83.01) falls within the "C category" and the 90th **percentile** value (83.38) also falls within the "C category".

Interpretation:

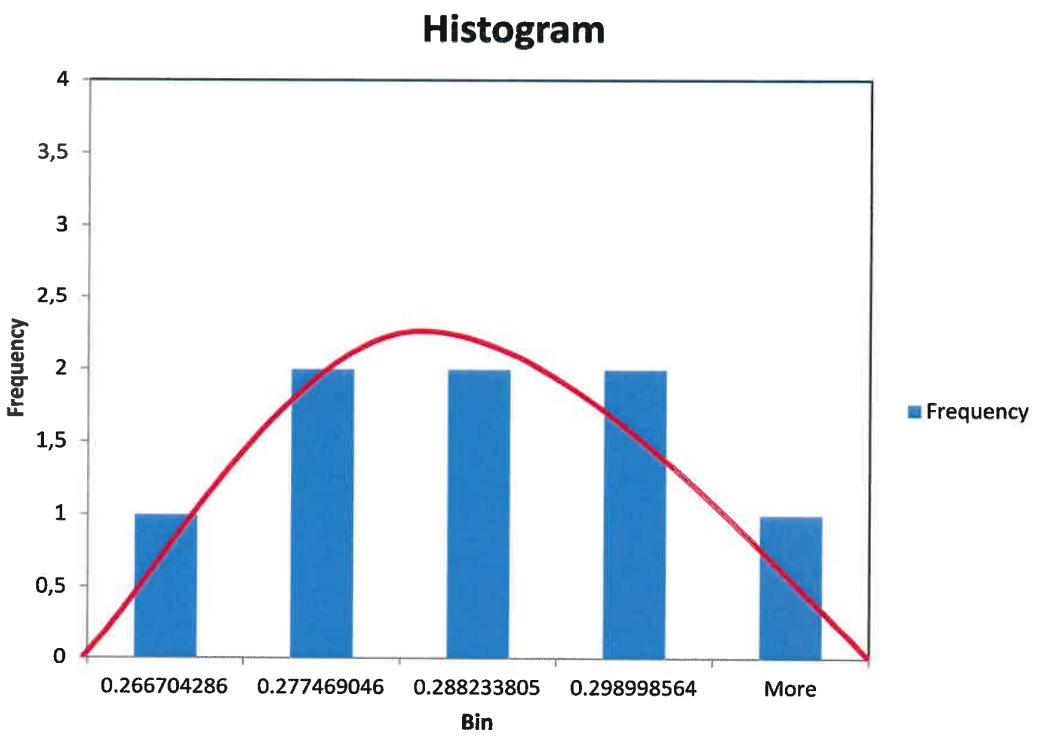
Determine if 95% of the samples taken falls within 2**SD** form the mean value.

- 95% of the samples must be between "Mean - 2**SD**" (82.11) and "Mean + 2**SD**" (83.82)
- From the data zero samples are smaller than "Mean - 2**SD**" and zero samples are than "Mean + 2**SD**".

None out of eight samples falls outside the 2**SD** form the mean value, which represents 0% of the sample group (i.e. 1/8 x 100 = 0%). This is less than the allowable 5% and therefore the **HEG** is statistically correctly defined.

Action to be performed:

Draw a histogram to graphically indicate the data.



Mechanical workshop noise measurement results:

SOUND PRESSURE LEVEL DATA (dBA)	CALCULATED RMS SOUND PRESSURE (Pa)
85	0.355655882
85.1	0.359774183
85.2	0.363940172
86.3	0.413076031
86.7	0.432543705
86.4	0.417859226
87.7	0.485322019
88.5	0.532145012

DESCRIPTIVE STATISTICS	
Mean	0.42004
Standard error	0.022346
Median	0.415468
Mode	#N/A
SD	0.063204
Sample variance	0.003995
Kurtosis	-0.2504
Skewness	0.77433
Range	0.176489
Minimum	0.355656
Maximum	0.532145
Sum	3.360316
Count	8
Confidence level (95.0%)	1.37295

Calculations from the descriptive statistical analysis:

CALCULATIONS	
Mean	= 0.420
2 x **SD**	= 0.126
Mean - 2**SD**	= 0.294
Mean + 2**SD**	= 0.546
90th **percentile**	= 0.499

Convert the calculated **RMS** sound pressure (Pa) back to sound pressure level (**dBA**):

CALCULATIONS	
Mean	= 86.45
Mean - 2**SD**	= 83.34
Mean + 2**SD**	= 88.73
90th **percentile**	= 87.95

Action to be performed:

From the calculation performed above it can already be estimated that this **HEG** IS statistically correct defined, as:

The mean value (86.45) falls within the "B category" and the 90th **percentile** value (88.95) also falls within the "B category".

Interpretation:

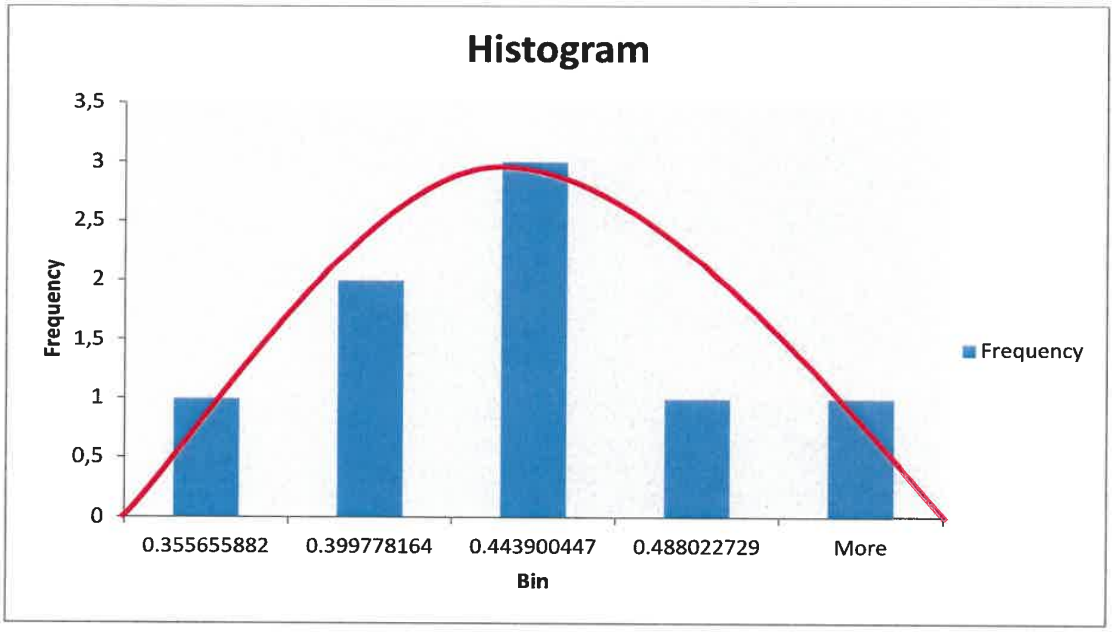
Determine if 95% of the samples taken falls within 2**SD** form the mean value.

- 95% of the samples must be between "Mean - 2**SD**" (83.34) and "Mean + 2**SD**" (88.73)
- From the data zero samples are smaller than "Mean - 2**SD**" and zero samples are than "Mean + 2**SD**".

None out of eight samples falls outside the 2**SD** form the mean value, which represents 0% of the sample group (i.e. 1/8 x 100 = 0%). This is less than the allowable 5% and therefore the **HEG** is statistically correctly defined.

Action to be performed:

Draw a histogram to graphically indicate the data.



ANNEXURE C: Mandatory classification bands

(This annexure forms part of the guideline and must be complied with)

CATEGORY	PERSONAL EXPOSURE LEVEL GENERAL ACTION
A	Exposures ≥ 105 **dB** $L_{Aeq,\,8h}$
B	Exposures ≥ 85 and < 105 **dB** $L_{Aeq,\,8h}$
C	Exposures ≥ 82 **dB** $L_{Aeq,\,8h}$ and < 85 **dB** $L_{Aeq,\,8h}$
D	Exposures < 82 **dB** $L_{Aeq,\,8h}$

Frequency Monitoring Table for Noise

CATEGORY	NUMBER OF SAMPLES AND FREQUENCY
A	5% or five samples per quarter
B & C	5% or five samples per annum to be evenly spread annually
D	Portfolio of evidence to be kept at the mine

ANNEXURE D: Reporting forms

(This annexure forms part of the guideline and must be complied with)

REPORTING FORM

MINE NAME:	
QUARTERLY NOISE EXPOSURE REPORT FORM 21.9(2)(e) in terms of regulation 9.2.(7)	
MAIN COMMODITY CODE:	
SAMPLE AREA:	
ACTIVITY AREA CODE:	
HEG DESCRIPTION:	
HEG CLASSIFICATION BAND: (based on 90th percentile statistical analysis of the previous annual results)	
ANNUAL 90th PERCENTILE RESULT FOR THE HEG: (based on all individual measurements obtained from all quarters during the previous measurement cycle)	

DMRE MINE CODE:	
SUB MINE CODE:	
REPORTING PERIOD: (e.g. January to March)	

NUMBER OF EXPOSED EMPLOYEES: (where there are new employees, number of exposed employees reported should be progressive)	**Q1**	**Q2**	**Q3**	**Q4**	**ANNUAL RESULTS**
NUMBER OF SAMPLES PLANNED FOR THE CURRENT SAMPLING CYCLE:					
NUMBER OF SAMPLES TAKEN:					
QUARTERLY HEG CLASSIFICATION: (based in the Log average)					

OCCUPATION CODE IN HEG	**OCCUPATION DESCRIPTION IN A HEG**	**NUMBER OF PERSONS PER OCCUPATION**	**Each recorded sound pressure level measured ($L_{Aeq, 8h}$) within the HEG linked to the occupation code**
		Logarithmic average sound pressure level of the HEG. results to be allocated to medical record	

Reasons for individual result/s exceeding the annual HEG Classification	
Corrective actions that will be implemented to mitigate the individual result/s exceeding the annual HEG Classification	

ANNEXURE E: **Noise** register template

(For information purposes only)

EQUIPMENT NOISE REGISTER			
Commodity:		**Mine name:**	
Shaft / operation:		**Date updated:**	

EQUIPMENT INFORMATION																							
Type of mining	Activity area	Description of HEG exposed	Equipment type	Power source (pleumtic / electric / electro hydraulic / hydropower)	Equipment model	Manufacturer / supplier	Equipment noise silencing control measures implemented	Noise emission level in dBA (log average)				Number of pieces of equipment per noise emission category											
								Quarter 1	Quarter 2	Quarter 3	Quarter 4	> 82, but < 85 dBA				> 85, but < 105 dBA				> 105 dBA			
												Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

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ANNEXURE F: Guidance note for **noise** measurement of equipment to ensure conformance with **MHSC** milestones

(For information purposes only)

GUIDANCE NOTE FOR NOISE MEASUREMENT OF EQUIPEMENT TO ENSURE CONFORMANCE WITH MHSC MILESTONES

BACKGROUND

The **MHSC** has established the following milestones for limiting occupational **noise** exposure and eliminating **NIHL**.

Quietening of equipment

"By December 2024, the total operational or process **noise** emitted by any equipment must not exceed a milestone sound pressure level of 107 **dBA**."

This milestone of the sound pressure levels will be verified by initiatives under the Centre of Excellence and MOSH, and reviewed in 2016.

For individuals

"By December 2016, no employee's **STS** will exceed 25 **dBA** from the baseline when averaged at 2 000 **Hz**, 3 000 **Hz** and 4 000 **Hz** in one or both ears."

PURPOSE

To manage the **noise** hazard effectively, industry focus must be on a strategy to eliminate and control **noise** at source by implementing an accepted, practical and effective industry-wide "*buy-and-maintain-quiet*" initiative. This initiative is the outcome of a standing decision taken by mining companies to procure equipment / machinery, and maintain existing equipment that conforms to specific **noise** emission requirements.

This document serves as an industry guideline for the implementation of the 2014 **noise** milestones. It also details the required **noise** measurement procedure to ensure the employment of uniform measurement procedures under realistic operating conditions.

The guideline has been developed for use by persons who have been found competent by the occupational hygienist appointed under section 12.1 of the **MHSA** to conduct **noise** measurements by virtue of their knowledge, training and experience.

NOISE MEASUREMENT FOR INDIVIDUAL PIECES OF EQUIPMENT AND MACHINERY

MEASUREMENT CRITERIA

Noise levels should be measured directly with an **ISLM** that meets at least the accuracy requirements for a class-2 instrument (given in IEC 61672-1 and SANS 61672-1), and is fitted with a windshield specified by the **ISLM** manufacturer. The following measurement criteria should be applied:

- **OEL**: 85 **dBA**.
- Threshold level/low threshold limit: 80 **dBA**.
- Energy exchange or doubling rate: 3 **dBA**.

The instrument supplier normally sets these measurement criteria prior to delivery, but this should be confirmed before use. For instruments with a facility to alter the measurement criteria via on-board software or firmware, the above criteria should be confirmed or corrected using the instrument's set-up mode.

INSTRUMENT SETTINGS

The following instrument settings should be used for $L_{Aeq,T}$ measurements:

- A-weighting: *on*
- Time weighting: "*fast*" or "*impulse*" if the **noise** is impulsive and the **SLM** has impulse-integrating capability. If the **noise** is impulsive but the **SLM** does not provide for impulse-integration, increase the measured $L_{Aeq,T}$ by 5 **dBA** for moderately impulsive **noise** (e.g. pneumatic rock drill) or 12 **dBA** for highly impulsive **noise** (e.g. compressed air-driven charging-up of blast holes or hammer blows in an artisan workshop)
- Sound incidence: where applicable, "*frontal*" if the microphone is facing a **noise** source, or "*random*" if the **noise** is non-directional / multi-directional
- Frequency filter: *out* (off)
- Operating mode: *integrate* or L_{Aeq}

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GENERAL PROCEDURES

The following general procedures must be followed for $L_{Aeq,T}$ measurements:

- Confirm the **SLM's** acoustic sensitivity with a sound calibrator immediately before and after each series of measurements, usually before commencing a shift and immediately after completion of the shift. This should be done using a class-2 calibrator (minimum) as defined in SANS 60942 / SABS-IEC 60942. If the two calibration checks do not coincide to within 1 **dBA [SANS 10083]**, results of the intervening measurements must be discarded and the measurements repeated.
- For the purpose of measuring individual pieces of equipment and machinery, measurements should be taken 1m away from the specific **noise** source, as far as reasonably practicable.

MEASUREMENT PROCEDURES

Measure $L_{Aeq,T}$ for a representative time at a selected microphone position:

- For steady **noise**, a measurement time of one minute is adequate.
- Where the **noise** varies or is cyclical, the measurement time should be sufficient to capture variations in level and include a reasonable number of work task cycles, to ensure representative results.

  This $L_{Aeq,T}$ measurement for the variation or cyclical **noise** level will then be recorded as the representative **noise** level for the individual piece of equipment or machine.

NEW (TYPE / DESIGN) EQUIPMENT CONSIDERATIONS

Noise measurements must comply with ISO 3744 / SANS3744. As a rule of thumb, the impact of the **noise** emitted from a new type or design of equipment underground can be estimated by doubling the sound pressure level measured on surface. This is achieved by adding 3 **dBA** to the **noise** level displayed on the manufacturer's certificate to allow for sound reflected from solid boundaries (reverberation).

REPORTING AND RECORDING RESULTS OF NOISE MEASUREMENTS

Data collection

- For equipment noise emissions above 100 **dBA**, the data collection will be based on sampling a minimum of 5% (or a minimum of 5 if there is less than 100 pieces of that particular equipment type) of that equipment type total population over a 12-month period (samples should be representative of the various activities).

(Refer to the example in Appendix 2)

The **logarithmic average** must be calculated for reporting purposes per quarter.

The following formula can be used to calculate the logarithmic average (L_{Aeq}):

$$L_{Aeq} = 10 \log \frac{(anti\log\frac{L1}{10} + anti\log\frac{L2}{10} + anti\log\frac{L3}{10} + anti\log\frac{L4}{10} + \cdots)}{n}$$

Where:
L = the noise levels measured (L_{Aeq}) in **dBA** for equipment.
n = number of total samples

EXAMPLE:
(MINIMUM OF 5% OR A MINIMUM OF FIVE OVER A 12-MONTH PERIOD)

EXAMPLE ON QUARTER 1 DATA

Rock drill 1 = L1 = 105.0 **dBA**
Rock drill 2 = L2 = 103.8 **dBA**
Rock drill 3 = L3 = 108.2 **dBA**
Rock drill 4 = L4 = 104.6 **dBA**

$$L_{Aeq} = 10 \log \frac{(anti\log \frac{105.0}{10} + anti\log \frac{103.8}{10} + anti\log \frac{108.2}{10} + anti\log \frac{104.6}{10})}{n}$$

$L_{Aeq} = 105.8$ **dBA**
n = number of total samples

Note:
The example calculation above is based on the example quarter 1 data collected, based on a sampling strategy of sampling 5% of equipment or a minimum of five samples over 12-month period (whichever is the greater) and explained in more detail below.

CALCULATION OF THE LOGARITHMIC AVERAGE

For quarter 1 the logarithmic average for the quarter is calculated using readings 1, 2, 3 and 4 as indicated below. The same applies to calculate the log average for the quarter going forward.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Log average	105.8	105.4	103.9	106.0
Log average for quarter		105.6	104.8	105.3
Reading (1)	105.0	104.1	105.7	105.0
Reading (2)	103.8	105.6	99.9	103.8
Reading (3)	108.2	106.9	104.2	108.2
Reading (4)	104.6	104.2	-	104.6
Reading (5)	-	-	-	106.9

CALCULATION OF THE ROLLING LOGARITHMIC AVERAGE

To calculate the logarithmic rolling average for quarter 2, readings 1, 2, 3 and 4 of quarter 1 as well as readings 1, 2, 3 and 4 of quarter 2 are used as indicated below. The same applies for the next quarters.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Log average	105.8	105.4	103.9	106.0
Log average for quarter		105.6	104.8	105.3
Reading (1)	105.0	104.1	105.7	105.0
Reading (2)	103.8	105.6	99.9	103.8
Reading (3)	108.2	106.9	104.2	108.2
Reading (4)	104.6	104.2	-	104.6
Reading (5)	-	-	-	106.9

For equipment between 85 **dBA** and 100 **dBA** data collection will be based on the noise risk register as follows:

- Identify the equipment to be measured.
- Determine background area for the measurement.
- Identify the equipment that can be switched-off safely.
- Switch-off the identified equipment.
- Record the background noise.
- List the equipment that could not be switched off during the recording of the background noise.
- Record equipment noise.

(Refer to the example in Appendix 1)

DATA REPORTING

- Noise data will be reported using rolling log averages on a quarterly basis.
- Total number of pieces of equipment type must be reported quarterly.

(Refer to the example in Appendix 2)

Results should be recorded and documented so as to ensure uniform workplace operating conditions, measurement procedures and microphone positions, thereby allowing meaningful comparisons with future results. The following information must be recorded:

- **Instrument type, serial number (including microphone), calibration data, etc.**
- **Working place, environmental and equipment information such as:**

- Mining company
- Mine / shaft / operation
- Commodity
- Type of mining
- Workplace (use Annexure A: Mandatory codes e.g. stoping, development, etc.)
- Excavation area (m^2)
- Type of excavation
- Equipment being measured - name and description
- Model / type
- Serial / equipment number
- Equipment category
- Power source (pneumatic / electric / electro hydraulic / hydro power)
- Manufacturer / supplier
- Activities/processes measured

- Activities - equipment that runs continuously e.g. pump, compressor, etc.
- Process - cyclical operations e.g. rock drill collaring, drilling and extracting, etc.
- Silenced / not silenced.
- Number of pieces of equipment per shaft.
- Noise level (**dBA**) - (log average to be recorded
- Noise level (**dBA**) - (all scenarios to be recorded).
- Type of ventilation.
- Air velocity.
- List background noise levels and the sources that constitute the background noise.
- Compressed air pressure for pneumatic-driven equipment.
- Date of report.

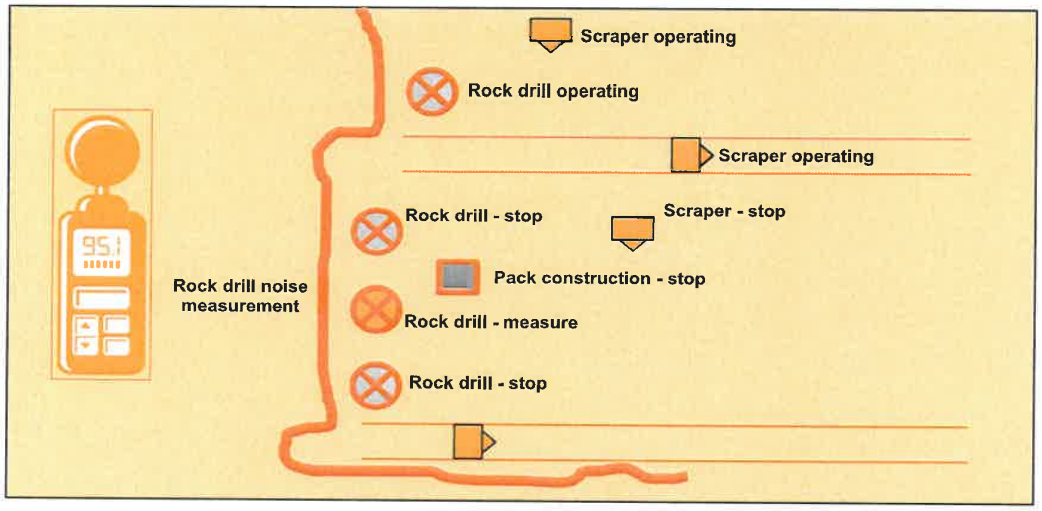
APPENDIX 1

EXAMPLE OF EQUIPMENT NOISE MEASUREMENT PROCESS

When the noise level of an individual piece of equipment needs to be measured, the environment in which the measurement will take place must be assessed to determine which other equipment is operating in the vicinity. This is necessary as such background noise will have an effect on the noise measurement results of the piece of equipment to be measured. In order to obtain the most accurate noise measurement result, it is important to isolate any other operating equipment as far as practicable. Only equipment which can be safely isolated and which will not have an effect on the health and safety of employees should be isolated. The type of equipment which could not be isolated must be recorded and included in the noise measurement report.

BELOW ARE THE STEPS TO FOLLOW PRIOR TO PERFORMING NOISE MEASUREMENT ON AN IDENTIFIED PIECE OF EQUIPMENT:

1. Identify the equipment to be measured.
2. Determine the background **noise** level present in the area to be measured (define the distance away from the equipment to be measured e.g. 6m away).
3. Which equipment or activities can be safely stopped or switched off?
4. Isolate the equipment and activities identified in step 3 above, where required.
5. Conduct background **noise** measurements.
6. Record the background **noise** level present, together with the relevant information on the equipment and/or activities which could not be isolated.
7. Conduct **noise** measurements according to steps 3 and 4 above. Measurement of any cyclic equipment must take place from the initial start to the end of such cycle i.e. a rock drill will be measured from starting the machine, collaring, drilling and withdrawing the machine.
8. Once the **noise** measurement process for the equipment being evaluated is complete, all other equipment and/or activities which constituted the background **noise** within the area could be restarted and the entire process should be repeated for every other piece of equipment to be evaluated.
9. Record all the other relevant information, as specified in the data reporting section of the guidance note for **noise** measurement of equipment to ensure compliance with **MHSC** milestones (the report should also indicate the microphone positions in relation to the equipment and surroundings evaluated, for future reference).



APPENDIX 2

EQUIPMENT NOISE REPORTING GUIDE

Background

During 2016, the Minerals Council South Africa published a "*Guidance Note on the Noise Measurement of Equipment to Ensure Compliance with **MHSC** Milestones*" factsheet.

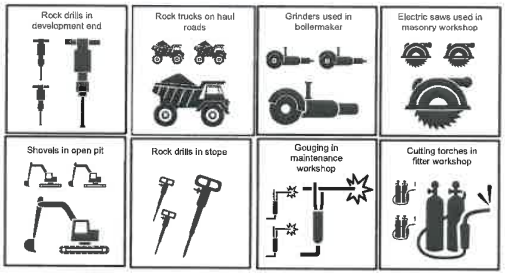
The purpose of this guidance note was to serve as an industry guideline for the implementation of the **MHSC** noise milestones, and also detail the required noise measurement procedures to ensure the employment of uniform measurement procedures under realistic operation conditions. This would allow for the comparability of the noise measurement data of various mines, as part of the South African mining industry's journey towards compliance to the **MHSC** noise milestones.

Purpose

The purpose of this step-by-step guide is to assist mining companies in grouping (also referred to as equipment populations) of equipment for noise measurement, as well as recording and reporting of individual pieces of equipment. It is envisaged that the implementation of this step-by-step allow for comparable equipment noise reporting by mining companies.

STEP-BY-STEP EQUIPMENT NOISE REPORTING GUIDE

STEP 1:
Group equipment according to the equipment type / model into populations based on the activity area in Annexure A: Mandatory codes (e.g. S215 rock drills used in stoping activity area as a population).



STEP 2:
Conduct **noise** measurements on 5% of the equipment population, as per activity area (e.g. five samples for an equipment population of 100 S215 rock drills per activity area).

STEP 3:
Calculate the logarithmic average **noise** level for the equipment population, making use of the **noise** measurement results obtained in step 2.

$$L_{Aeq} = 10 \log \frac{(anti\log \frac{105.8}{10} + anti\log \frac{103.8}{10} + anti\log \frac{108.2}{10} + anti\log \frac{104.6}{10})}{n}$$

L_{Aeq} = 105.8 **dBA** n = number of total samples

STEP 4:
Report the logarithmic average **noise** result from step 3 for the equipment population for **noise** milestone tracking purposes and not according to individual measurement results.

Calculation of the logarithmic average

For quarter 1 the logarithmic average for the quarter is calculated using readings 1, 2, 3 and 4 as indicated below. The same applies to calculate the log average for the quarter going forward.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Log Average	105.8	105.4	103.9	106.0
Log Average for quarter		105.6	104.8	105.3
Reading (1)	105.0	104.1	105.7	105.0
Reading (2)	103.8	105.6	99.9	103.8
Reading (3)	108.2	106.9	104.2	108.2
Reading (4)	104.6	104.2	–	104.6
Reading (5)	–	–	–	106.9

A: This logarithmic average result of the **noise** measurements for the entire population of equipment measured will be used for the reporting of **noise** milestone tracking.

B: This individual piece of equipment within the equipment population should be investigated (step 5) and not reported as an individual piece of equipment exceeding 107 **dBA**.

*Note: Should the logarithmic average **noise** result for the equipment population be greater or equal to 107 **dBA**, then the entire S215 rock drill population used in the stoping activity area is reported as equipment greater or equal to 107 **dBA**.*

STEP 5:
Investigate any individual **noise** measurement recorded for the sampled equipment population which was equal to or above the milestone sound pressure limit of 107 **dBA**.

*Note: The workplace information specified in the "Data reporting" section of the "Guidance Note on the **Noise** Measurement of Equipment to Ensure Compliance with **MHSC** Milestones" factsheet should inform the investigation process*

ANNEXURE G: Quality assurance for **noise** measurement and recording
(For information purposes only)

Determination of the equivalent continuous rating level ($L_{Req.T}$)

Sound measuring equipment

Integrating sound level meter configuration, that complies at least with the accuracy requirements specified for a type-2 instrument in SANS 61672-1 and SANS 61672-2. Use a windscreen of a type specified by the manufacturer as being suitable for the particular microphone and which does not detectably influence the accuracy of the meter under the ambient conditions of the test.

Sound calibrator that complies with the requirements prescribed for a type-2 calibrator in SANS 60942.

Calibration of equipment

General

Ensure that all items of sound measuring equipment used are calibrated against the requirements of SANS 60942, SANS 61672-1 and SANS 61672-2 (by an accredited facility), at intervals not exceeding one year for the sound calibrator and two years for the rest of the equipment, that it comply with the requirements for accuracy as required.

The calibration **laboratory** should:

a) Prove traceability in accordance with the relevant national legislation.

b) Implement and maintain a quality management system in accordance with SANS 17025.

c) Be accredited by a recognized accreditor.

NOTE:
If the equipment is repaired, it should not be put into service before a comprehensive calibration is undertaken in accordance and an availability of a calibration certificate.

Acoustic sensitivity

Using the sound calibrator, the acoustic sensitivity of the meter immediately before and after each series of sound level measurements should be checked and the results of the sound measurements should be discarded if the two checks do not coincide to within 1.0 **dB**.

NOTE:
If measurements are conducted over extended time periods for each series, acoustic sensitivity checks should be conducted at regular intervals, i.e. at least once or twice a day.

Microphone positions

Single locations (where the risk to the only occupant has to be determined).

Place the microphone at the approximate position of the person's ear that receives the higher sound level.

Larger areas (where the average risk to the people in the area has to be determined).

Where practicable, ensure that the microphone is about 1.5m above the floor or ground (as relevant) and at least 1.2m away from walls and other large flat surfaces, and scan the area under investigation with the microphone while the instrument is integrating. Alternatively, select at least three positions that are well distributed over the area under investigation, use the following microphone heights and take measurements at each position:

a) For standing persons: 1.5m above the floor or ground on which the persons are standing.

b) For seated persons: 0.9m above the middle of the seat plane, with the seat set at, or as near as possible to, the midpoint of its horizontal and vertical adjustment.

NOTE:
If the workers' locations are very close to the **noise** sources, the microphone position and direction have to be precisely stated in the test report.

Interference

Ensure (as far as possible) that the measurements are not affected by **noise** from extraneous sources and extraneous influences, for example wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. The measured signal should preferably be at least 10 **dB** higher than that of any unavoidable extraneous **noise** and other interference. If this difference is from 3 **dB** to 9 **dB**, the appropriate correction may be calculated in accordance with the following equation:

$$L_{\text{corr}} = 10 \log [10^{L_{\text{m}}/10} - 10^{L_{\text{i}}/10}]$$

Where:

- L_{corr} is the corrected sound pressure level
- L_{m} is the measured sound pressure level.
- L_{i} is the interference sound pressure level.

If the difference is less than 3 **dB**, the readings taken during the period of the interference should be discarded.

Measurement time intervals

Choose measurement time intervals such that the results are representative of the shift time interval, and that the variations in the rating level owing to the variation of the emission at the source, are adequately covered. The choice of the measurement time interval will depend on the method of data acquisition and on the time structure of the **noise**.

If the **noise** displays a clear periodicity, ensure that the measurement time intervals cover at least three periods, where possible. If continuous measurement over the period is not possible, choose the time intervals that each represents a part of the cycle, and that together represent a complete sample that is characteristic of the **noise**. If the sound pressure level

varies stepwise, select the measurement time intervals that each represents a period within which the **noise** can be considered approximately steady. If the **noise** is of a random nature, choose the measurement time intervals as to give sufficient independent samples to adequately characterize the **noise**.

NOTE 1:
The measurements should preferably be made for the entire duration of a normal work day shift. If the measurement time intervals are shorter than the duration of a normal shift, the individual measurement time intervals, when added together should constitute the duration of the entire shift time interval.

NOTE 2:
If the measurements are sampling measurements, the sampling equivalent continuous rating levels should be representative of the entire measurement time interval during which they are taken, and should be allocated the entire measurement time interval which they represent.

NOTE 3:
If the shift duration is other than 8-hour, the equivalent continuous 8-hour rating levels should be calculated in accordance.

NOTE 4:
If the shift time interval is -hour the shift time interval becomes the 8-hour reference time interval.

Procedures to determine the rating level ($L_{\mathrm{Req,\,T}}$)

General

Three alternative procedures are described in descending order of preference, to permit different classes of instruments to be used. In cases of dispute, use the procedure using I-time weighting and integration (preferred procedure).

NOTE 1:
If the **noise** level varies significantly over a period of time or from day to day, enough additional measurements should be taken to cover a full cycle of **noise** variations.

NOTE 2:
In the case of a steady **noise**, the value of the **equivalent continuous A-weighted sound pressure level** may be obtained directly by visually averaging the readings on a sound level meter that complies with the prescribed requirements, while using S-time weighting, provided that the **noise** variations do not exceed 5**dB**.

Impulsive sound

Procedure using I-time weighting and integration (preferred procedure)

Use this procedure when instrumentation is available that can integrate while using I-time weighting. Carry out the procedure as follows:

a) Set the meter to A-weighting and select I-time weighting.

b) Measure the **equivalent continuous A-weighted sound pressure level** ($L_{\mathrm{Aeq,\,T}}$) directly, using an appropriate microphone position, during a suitable measurement time interval.

c) Where a number of individual measuring positions have been selected, follow the above procedure for each position and calculate the average on a mean square pressure basis as per below formula, to obtain the rating level ($L_{Req,T}$).

$$L_{Req,T} = 10 \log \frac{1}{n} \sum_{i=1}^{n} 10^{L_{Req,Ti}/10}$$

Where:

- $L_{Req,Ti}$ is the equivalent continuous rating level at the i-th measurement position.
- n is the number of measurement positions (at least three).

d) For composite measurements, use the equation:

$$L_{Req,T} = 10 \log \sum_{f_i} 10^{L_{Req,Ti}/10}$$

Where:

- $L_{Req,Ti}$ is the equivalent continuous rating level at the i-th partial level.
- f_i is the duration of each partial $L_{Req,Ti}$ expressed as a fraction of the total time over which $L_{Req,T}$ is calculated.

NOTE:
Where sampling techniques are used to determine the representative equivalent continuous rating level the duration f_i will represent the proportionate duration fraction of the sound level which is representative of the total portion of the measurement time interval to which the particular sample applies, and not the actual duration of the sample measurement.

Procedure using integration and a derived impulse correction (C_i)

Use this procedure when the available instrumentation is equipped with an integration function, an S-time weighting function and an I-time weighting function, but is not capable of integrating while the time weighting functions are being applied. Carry out the procedure as follows:

a) Set the meter to A-weighting and select the integrating mode.

b) Measure the **equivalent continuous A-weighted sound pressure level** ($L_{Aeq,T}$) directly, using an appropriate microphone position, during a suitable measurement time interval.

c) Select the sound pressure level mode and I-time weighting and note the average maximum reading.

d) Select the sound pressure level mode and S-time weighting and note the average maximum reading.

e) For each measurement position and each measurement time interval, calculate the difference between the readings obtained in (c) and (d) above, and call this the impulse correction (C_i).

$$C_i = L_{p,I} - L_{p,S}$$
$$(C_i \geq 0)$$

Where:

- $L_{p,I}$ is the sound pressure level measured in accordance with (c).
- $L_{p,S}$ is the sound pressure level measured in accordance with (d).

f) Add C_i to the reading obtained in (b) above, to obtain the rating level ($L_{Req,T}$) i.e. $L_{Req,T} = L_{Aeq,T} + C_i$

g) Where a number of individual measuring positions have been selected, follow the above procedure for each position and calculate the average on a mean square pressure basis to obtain the rating level ($L_{Req,T}$).

h) For composite measurements, use equation:

$$L_{Req,T} = 10 \log \sum_{f_i} 10^{L_{Req,Ti}/10}$$

NOTE:
The measurements described under (a) to (d) should be done simultaneously (unless the **noise** radiation is absolutely homogeneous and constant). This means that three sound level meters should be used, or a recording should be made which may be analysed in sequence afterwards. If a recording of the **noise** is made, it should be ensured that the record/replay characteristics of the entire chain of the equipment comply with the requirements of SANS 61672-1 and SANS 61672-2, and that a calibration signal is recorded before and after each recording.

Procedure using integration and an estimated impulse correction (C_i)

Use this procedure when only a simple integrating sound level meter without appropriate additional functions is available. Carry out the procedure as follows:

a) Set the meter to A-weighting and select the integrating mode.

b) Measure the **equivalent continuous A-weighted sound pressure level** ($L_{Aeq,T}$) directly, using an appropriate microphone position, during a suitable measurement time interval.

c) Decide whether the **noise** is of an impulsive nature, if so, add an impulse correction (C_i) of:

i. Five to the reading obtained in (b) above, in the event of regular impulsive sound.
ii. 12 to the reading obtained in (b) above, in the event of highly impulsive sound to obtain the rating level ($L_{Req,T}$) i.e.

$$L_{Req,T} = L_{Aeq,T} + C_i$$

Where:

- C_i is +5 **dB** for regular impulsive sound.
- C_i is +12 **dB** for highly impulsive sound.
- C_i is 0 in all other cases.

NOTE:
For high-energy impulsive sounds, advice by a specialist should be obtained. It may, in these cases be accepted that the equivalent continuous rating level exceeds the maximum allowable limit and special **hearing conservation** measures are required.

d) Where a number of individual measuring positions have been selected, follow the above procedure for each position and calculate the average on a mean square pressure basis, to obtain the rating level ($L_{\mathrm{Req,T}}$).

e) For composite measurements, use equation:

$$L_{\mathrm{Req,T}} = 10 \log \sum_{f_i} 10^{L_{\mathrm{Req,Ti}}/10}$$

NOTE:
The impulse correction is only added, individually or separately, for the measurement time intervals when it was present in the **noise** emission.

Determination of the shift equivalent continuous, rating level ($L_{\mathrm{Req,Ts}}$)

Using the procedures given above, calculate the shift equivalent continuous rating level as follows:

$$L_{\mathrm{Req,Ts}} = 10 \log \frac{1}{T_s} \sum_{T_i} 10^{L_{\mathrm{Req,Ti}}/10}$$

Where:

- $L_{\mathrm{Req,Ts}}$ is the equivalent continuous rating level, determined for a time interval of the duration of the work shift.
- $L_{\mathrm{Req,Ti}}$ is the individual equivalent continuous rating level, determined for the individual measurement time intervals (T_i).
- T_i is the individual measurement time intervals for the measured equivalent continuous rating levels ($L_{\mathrm{Req,Ti}}$).
- T_s is the total duration of the work shift.

NOTE:
$L_{\mathrm{Req,Ts}}$ may be determined for a series of measurement time intervals which, when added together, represent the total shift time interval. If a sampling procedure is used, the individual measurement time intervals should be representative of the entire measurement time interval, and should be calculated for the time intervals which they represent, and not for the actual time durations over which the measurements were conducted. Thus, the individual measurement time intervals in the equation, when added together should result in the total shift time interval.

Determination of the 8-hour equivalent continuous rating level ($L_{\mathrm{Req,8h}}$)

If the individual work shifts differ in duration from a normal 8-hour work shift, the 8-hour equivalent continuous rating level ($L_{\mathrm{Req,8h}}$) should be calculated from the following equation:

$$L_{\mathrm{Req,8h}} = L_{\mathrm{Req,Ts}} + 10 \log \frac{T_s}{8}$$

Where:

- $L_{\mathrm{Req,8h}}$ is the equivalent continuous 8-hour rating level.

- $L_{Req,\,Ts}$ is the equivalent continuous rating level, determined for a time interval of the duration of the work shift.
- T_s is the total duration of the work shift in hours.
- Eight is the total duration of the reference time interval in hours.

NOTE:
If the time duration of the work shift is 8-hours, the equivalent continuous shift rating level becomes the equivalent continuous 8-hour rating level and the above calculation is not required.

Preparation for assessment of measurement area

1. The purpose of this procedure is to determine the boundaries of **noise zones** for purposes of demarcation.

2. Obtain a plan of the measurement area or draw a dimensioned sketch. Show the relevant positions of **all** equipment or processes that create **noise** and indicate adjacent reflecting and absorbing surfaces. Use this plan or sketch as a basis for zoning the area.

3. Carry out a preliminary survey of **noise** levels in the entire measurement area, using short duration $L_{Req,\,T}$ measurements. Identify work areas, operators' positions and any other location that can be accessed, where the 8-hour **noise** rating level ($L_{Req,\,8h}$) equals or exceeds 85 **dBA**.

4. Use the information obtained from the above survey to determine preliminary **noise zone** boundaries. Indicate on a plan or sketch the preliminary boundaries of **noise zones** where the 8-hour rating level ($L_{Req,\,8h}$) equals or exceeds 85 **dBA**. Ensure that every area, or location that can be accessed, where the 8-hour rating level ($L_{Req,\,8h}$) equals or exceeds 85 **dBA** is included within the boundaries of a **noise zone**.

Procedures for drivers' cabins of vehicles and operators' positions for machinery and equipment

Measurement procedures

1. Determine the rating level in accordance with over-sufficient measurement time intervals in such that all significant variations of the **noise** levels at the operator's position are measured and included. Ensure that during the measurement time interval, the **noise** that is characteristic of the specific work area and that is representative of the activities performed by the employee, does actually occur. For monitoring tests, slight deviations from the type test conditions may be tolerated, for example, the microphone positions and operating conditions as required.

Operating conditions

2. Determine the rating level under normal operating conditions and detail these conditions in the test report.

NOTE:
For measurements where the employee moves around continuously, or is operating a vehicle, it is recommended that the **noise** exposure be determined in accordance with requirements of personal dosimetry.

Reassessment of measurement area (rezoning)

1. If any changes occurred (for example, changes in production processes, machinery, and position of large surfaces, or a combination of these) that could result in a change in, or redistribution of, **noise** levels, or if there is any suspicion that the previous assessment is no longer valid, it is necessary to reassess the measurement area.

2. If there is a reduction in **noise** levels, reassessment could result in the de-restriction of areas previously classified as **noise zones**.

3. Owing to the aging and normal wear and tear of equipment, it is advisable that the **noise** measurements be repeated at intervals not exceeding two years.

Reduction of **noise**

1. In areas where the 8-hour rating level ($L_{\mathrm{Req,\,8h}}$) equals or exceeds 85 **dBA**, use the best reasonably practical engineering means to reduce the **noise** to below this limit, for example by acoustically enclosing the machines or the processes or the operator.

NOTE:
For the best practicable engineering means to reduce **noise** levels, see SANS 11688 and SANS 11690.

Personal dosimetry

Calculation of noise exposure levels

NOTE:
This **noise** exposure level is not the same as the A-weighted sound exposure level referred to in SANS 10103.

Procedure using sound exposure

Sound exposure meter

For personnel without fixed work locations (for example supervisors, overseers, maintenance staff and drivers of vehicles) or for personnel who have been identified as being unduly sensitive to **noise**-induced impairment of hearing, the value of the A-weighted sound exposure ($E_{\mathrm{A,\,T}}$) can be determined (on a regular sampling basis) by means of personal sound exposure meters that comply with the relevant accuracy requirements of IEC 61252.

Procedure

The personal sound exposure meter should be worn in accordance with the manufacturer's instructions.

Position the microphone of the sound exposure meter approximately 0.10m from the ear that receives the higher value of the rating level.

NOTE 1:
A helmet or frame can be used to support the microphone.

NOTE 2:
The microphone should be positioned on the shoulder of the employee, if convenient.

NOTE 3:
If the measuring instrument or parts of it are worn on the employee, care should be taken not to disturb the performance of the person and especially not to introduce safety risks. Similarly, care should be taken to avoid misuse of the instrument during measurements.

NOTE 4:
The position of the microphone should be reported.

Operating conditions

Determine the exposure rating level under normal operating conditions compared to the **OEL** and a 3 **dB** exchange rate, over a sufficiently long period of time to be representative of the individual's exposure to **noise**.

Calculation procedure

The **noise** exposure level normalized to a nominal 8-hour workday, ($L_{EX,\ 8h}$), in **dB**, is calculated from the A-weighted sound exposure, ($E_{A,\ Te}$) in pascal squared seconds ($Pa^2.s$), using the following equation:

$$L_{A,\ Te} = 10 \log \frac{E_{A,Te}}{1.15\ x\ 10^{-5}}$$

Where:

- $E_{A,\ Te}$ is the A-weighted sound exposure over a time interval (T_e), in pascal squared seconds ($Pa^2.s$).
- T_e is the effective duration of the workday in hours.

Selected values of sound exposures with corresponding values of **noise** exposure levels normalized to a nominal 8-hour workday are given for illustration in the table below:

A-weighted sound exposures ($E_{A,\ Te}$) and corresponding values of noise exposure levels normalized to a nominal 8-hour workday ($L_{ex,\ 8h}$).

1	2
$E_{A,\ Te}$ $Pa^2.s.10^{-3}$	$L_{ex.\ 8h}$ dB
0.364	75
0.458	76
0.576	77
0.726	78
0.913	79
1.15	80
1.45	81
1.82	82
2.29	83
2.89	84
3.64	85
4.58	86
5.76	87
7.26	88

1	2
$E_{A,Te}$ $Pa^2.s.10^{-3}$	$L_{ex,8h}$ dB
9.13	89
11.5	90
14.5	91
18.2	92
22.9	93
28.9	94
36.4	95
45.8	96
57.6	97
72.6	98
91.3	99
115.0	100

Notes on the use of personal sound exposure meters:

- Personal sound exposure meters may not be used for the demarcation of **noise zones**.
- IEC 61252 specifies acoustical and electrical performance requirements for personal sound exposure meters of only one accuracy grade. This accuracy grade corresponds to that of an integrating sound level meter which complies with the type-2 requirements of SANS 61672-1 and SANS 61672-2 for an **A-weighted sound pressure level** range from 80 **dBA** to 130 **dBA** and a nominal frequency range from 63 **Hz** to 8 **kHz**.
- The report should indicate that a sound exposure meter / dosimeter was used for the measurements.

ANNEXURE H: Instruction 171
(For information purposes only)

GOVERNMENT GAZETTE
16 MAY 2001
No. 22296

A61311
A 10/4/3/4

Circular instruction no. 171

THE DETERMINATION OF PERMANENT DISABLEMENT RESULTING FROM HEARING LOSS CAUSED BY EXPOSURE TO EXCESSIVE NOISE AND TRAUMA

1. **COIDA**

The following instructions are issued to clarify the position in regard to claims for impairment of hearing:

1.1. An occupational disease due to excessive **noise** in industry.

1.2. An occupational injury due to factors other than excessive industrial **noise** [head trauma (resulting from e.g. blows to the head), or acoustic trauma causing the immediate loss of hearing produced by one or more exposures to sudden intense forms of acoustic energy such as explosions, gunfire or blasts].

Such "accidents" may cause binaural (both ears) or monaural (one ear) impairment of hearing.

1.3. In loss of hearing "by accident" in either one or in both ears the impairment may be caused by either conductive loss when the middle ear is injured or by perceptive loss when the inner ear is injured or by a combination of both conductive and perceptive loss when both the middle and the inner ear are injured the so-called "mixed deafness".

1.4. Impairment of hearing claimed to result from exposure to excessive **noise** in industry (occupational **noise** of an excessive nature) usually manifests itself over a number of years and results in binaural impairment of hearing.

1.5. The provisions of section 65(4) of the **MHSA** of the act referring to prescription shall be strictly applied with due regard to the provisions of section 38 of the **MHSA**.

1.6. The date of the commencement of the disease shall be the date of the first audiogram showing an increase from the baseline in the **PLH** by 10% or more. The **PLH** values are calculated using the results of the **baseline audiogram** and the diagnostic audiogram using the attached tables.

1.7. **Persons to be submitted for compensation consideration would be:**

- Employees who's **PLH** has deteriorated by more than 10% **PLH** from the **baseline audiogram**.
- Employees who have more than 10% **PLH** and for whom no baseline is available (see section 5).

1.8. **A medical opinion must be provided by either:**

1.8.1. An **ENT specialist** if the case is complicated or the degree of disablement is expected to exceed 15% (**PLH** >30% from baseline).

1.8.2. An **OMP** if the case is uncomplicated and the degree of disablement is expected to be 15% or less (**PLH** 30% from baseline).

2. **Binaural hearing impairment**

In cases where binaural hearing impairment is claimed as a result of mechanical or acoustic trauma, the principles as laid down under paragraph 1.4, 1.5 and 1.6 for occupational hearing loss due to excessive **noise** in industry apply, with the exception that the **ENT surgeon** or **OMP** should certify that the impairment found on examination is compatible with the nature of the injury sustained, or is due to acoustic trauma of the nature and intensity experienced by the employee and that no other cause(s) for the impairment of hearing were found on examination.

3. **Monaural hearing impairment**

NIHL affects both ears to more or less an equal degree and the impairment is due to a perceptive loss. If, therefore, the loss of hearing is monaural, it must be assessed whether the loss is commensurate with **noise** exposure to one ear more than the other such as gun shots in security workers. The assessment of permanent disablement for the loss of hearing in one or both ears as detailed, takes cognisance of such additional factors as tinnitus, unhealed perforations of the tympanic membranes with possible recrudescence of infections following thereon and/or mastoidectomies. In the event of recurring infections in the two latter instances, medical treatment should be provided and the employee should receive periodical payments.

4. **Documentation to accompany a claim for compensation**

Claims will be submitted either to the Compensation Commissioner or the Mutual Association as applicable. Over and above the standard documentation required i.e. employer's report of an occupational disease / injury (WC1.1/2) and notice of an occupational disease / injury and claim for compensation (WC1.14/3), the following documents are required:

4.1. **Claimant's service record.** This should confirm, in writing, exposure to excessive occupational **noise**. The intensity and duration of exposure should be commensurate with the hearing impairment.

4.2. It should be proved that the **noise** was of such a nature and intensity, and exposure to it of such duration, as to be likely to have caused permanent **noise**-induced hearing impairment. The compensability of a claim can only be considered where **noise** level readings exceed the maximum laid down by the South African Bureau of Standards (SABS 083-1983) and which is known as the N85 **Noise** Rating Curve Level.

4.3. **Medical opinion.** This should state that the hearing loss is compatible with **noise** induced hearing impairment. In atypical cases, an appropriate explanation should be provided.

4.4. **Audiograms.** Two audiograms conducted by the diagnostic audiologist should be submitted. The audiograms should be performed after at least 24-hours have elapsed from the last exposure to excessive **noise**. The audiograms may be done on the same day but at different sittings. The audiograms must not differ by more than 10 **dB** at any frequency. The better diagnostic audiogram will be used to calculate the **PLH** for compensation purposes.

If required, a third audiogram shall be performed. If this is still not within the 10 **dB** limit, then the assessment shall be delayed for a period of six months. If audiograms of the required quality are still not obtained after six months, then referral to an **ENT specialist** will be made in order to determine hearing loss.

4.5. **A copy of the baseline audiogram** (and calculated **PLH**). This is important as the baseline **PLH** will be subtracted from the better diagnostic audiogram **PLH** to determine the hearing loss for which the Commissioner, Mutual Association or Employer Individually Liable, is responsible.

4.6. **Proof of employee's identity.** The audiologist performing the audiogram should attest in writing to the employee's identity.

5. **Calculation of permanent disablement**

5.1. The better of the two diagnostic audiograms will be used. Ensure that all documentation (4) is present and correct.

5.2. Calculate (from **PLH** tables - Annexure H: Instruction 171 published from the **COIDA** is as stated on this guideline under 5.2: Calculation of permanent disablement) a **PLH** for each of the following frequencies: 500 **Hz**, 1 000 **Hz**, 2 000 **Hz**, 3 000 **Hz** and 4 000 **Hz** (air conduction results to be taken except if specified otherwise by the medical officer).

5.3. Sum the values for each frequency to obtain the **PLH**.

5.4. If a baseline **PLH** is available, this value is subtracted from the **PLH** obtained from 5.3

5.5. If a baseline **PLH** is unavailable, the **PLH** in 5.3 is taken as the value from which permanent disability will be calculated.

5.6. Permanent disablement is calculated by halving the value of the **PLH** obtained in either: 5.4 (if a baseline **PLH** is available) or 5.5 (if a baseline **PLH** is unavailable).

6. Determination of PLH

Using the hearing threshold levels determined by baseline, periodic screening, exit or diagnostic audiometry (as applicable), determine the contribution to **PLH** from hearing losses at the frequencies of 0.5; 1; 2; 3 and 4 **kHz**, using tables A1-1 to A1-5, respectively. Then sum the contributions from the stated frequencies to determine **PLH**.

HTL in worse ear (dB)	4 contribution to PLH by hearing loss at 0.5 kHz in better ear and given hearing loss at 0.5 kHz in worse ear																
	Hearing threshold level in better ear (dB)																
	≤15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	≥95
≤15	1.2																
20	0.4	0.6															
25	0.6	1.0	1.4														
30	1.0	1.4	2.0	2.8													
35	1.3	1.8	2.5	3.4	4.5												

HTL in worse ear (dB)	5 contribution to PLH by hearing loss at 1 kHz in better ear and given hearing loss at 1 kHz in worse ear																
	Hearing threshold level in better ear (dB)																
	≤15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	≥95
≤15	0.5																
20	0.8	1.2															
25	1.2	1.8	2.7														
30	1.8	2.6	3.8	5.3													
35	2.6	3.5	4.7	6.3	8.5												

HTL in worse ear (dB)	6 contribution to PLH by hearing loss at 2 kHz in better ear and given hearing loss at 2 kHz in worse ear																
	Hearing threshold level in better ear (dB)																
	≤15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	≥95
≤15	0.3																
20	0.5	0.8															
25	0.8	1.1	1.7														
30	1.1	1.5	2.3	3.2													
35	1.5	2.1	2.9	3.8	5.1												

HTL in worse ear (dB)	7 contribution to PLH by hearing loss at 3 kHz in better ear and given hearing loss at 3 kHz in worse ear																
	Hearing threshold level in better ear (dB)																
	≤15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	≥95
≤15	0.1																
20	0.2	0.3															
25	0.3	0.5	0.7														
30	0.5	0.7	1.0	1.4													

HTL in worse ear (dB)	8 contribution to PLH by hearing loss at 4 kHz in better ear and given hearing loss at 4 kHz in worse ear																
	Hearing threshold level in better ear (dB)																
	≤15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	≥95
≤15	-																
20	0.1	0.1															
25	1.0	0.2	0.3														
30	0.2	0.3	0.5	0.8													
35	0.3	0.5	0.7	1.0	1.5												

16 November 2001

No. 1194

Instruction no. 171 (supplement)

Transitional arrangements between instruction no. 168 and no. 171

Introduction

This instruction sets out the procedures to be followed to ensure proper management and implementation of instruction no. 171 as well as a smooth transition from the repealed instruction no. 168 to the new instruction no. 171.

Conducting and recording of a baseline audiogram

1. A **baseline audiogram** must be conducted on all employees in any working place where the **equivalent continuous A-weighted sound pressure level**, normalised to an eight hour working day or a 40-hour working week, is equal to or exceeds 85 **dBA**.

2. A **baseline audiogram** must be conducted on every current employee exposed to **noise** as contemplated in (1) within two years of the date of this instruction.

3. From the date on which circular instruction 171 was published, every new employee exposed to **noise** as specified in (1) must have a **baseline audiogram** done within 30 days of commencement of employment.

4. The baseline of an employee conducted in terms of this instruction applies as that employee's baseline for his/her total working career.

5. An employee's baseline must be recorded and such record must be kept for 40 years.

Transfer between working places or changing employer

1. The **baseline audiogram** results, as well as the most recent subsequent audiogram conducted whilst in employment, should be given to an employee when he/she is no longer exposed to **noise** or leaves employment at that working place.

2. The **baseline audiogram** as well as the most recent audiogram with the **PLH** as calculated, must be presented at employment to the new employer.

3. At recruitment, the new employer must record the baseline as well as the subsequent **PLH** sustained with the previous employer, and the latter may be verified with an initial audiogram at recruitment.

Use of the baseline audiogram

1. The **baseline audiogram** must be used to calculate any current hearing loss sustained in terms of instruction no. 168. Where an employee has occupational hearing loss compensatable in terms of instruction no. 168, referral must be made to the Compensation Commissioner or the Mutual Association as applicable, for consideration of compensation.

2. The baseline must be recorded for the purpose of using these values for all future reference to the baseline of an employee.

3. The **baseline audiogram** should then be used in determining any future compensatable hearing loss in terms of instruction no. 171.

4. Following two years from the date of this instruction, where there was failure to conduct a baseline of an employee's hearing during these two years, it would be assumed that it was normal for the purposes of the baseline as set out in instruction no. 171.

Standards for the baseline audiogram

1. Testing for the **baseline audiogram** must be done 16 hours after an employee has been removed from an environment in which the **noise** level was equal to or exceeded 85 **dBA**. The use of hearing protection devices to effect this attenuation will not be acceptable.

2. The **baseline audiogram** is the better of the employee's two audiograms performed on the same day and that do not differ from each other by more than 10 **dB** for any of the following measured test frequencies, i.e. 0.5, 1, 2, 3, and 4 **kHz**.

3. If it is impossible to obtain two audiograms that comply with the requirements of (2), the employee must be referred to a competent person to establish baseline-hearing levels.

4. If it is impossible for the competent person to establish baseline-hearing levels as contemplated in (2), the competent person may establish baseline-hearing levels by using other techniques, such as speech reception thresholds.

This instruction supplements instruction no. 171.

ANNEXURE I: References

1) IEC 60942: Electro-acoustics - sound calibrators.

2) IEC 61672-1: Sound level meters, part 1: specifications.

3) ISO 11200:2014: Acoustics - **noise** emitted by machinery and equipment; guidelines for the use of basic standards for the determination of emission sound pressure levels at a work station and at other specified positions.

4) ISO 3744: Acoustics - determination of sound power levels and sound energy levels of **noise** sources using sound pressure; engineering methods for an essentially free field over a reflecting plane.

5) **SANS 10083**: The measurement and assessment of occupational **noise** for **hearing conservation** purposes.

6) SANS 3744: Acoustics - determination of sound power levels and sound energy levels of **noise** sources using sound pressure; engineering methods for an essentially free field over a reflecting plane.

7) SANS 60942: Electro-acoustics - sound calibrators.

8) SANS 61672-1: Electro-acoustics - sound level meters, part 1: specifications.

9) Mine Ventilation Society of South Africa: Learning material for the certificate in mine environmental control, workbook 5.