MINING INDUSTRY
OCCUPATIONAL
SAFETY & HEALTH

MINERALS COUNCIL
SOUTH AFRICA

GUIDANCE NOTE

FOR 3rd PARTY EQUIPMENT NOISE VERIFICATION MEASUREMENT

Background

The Mine Health and Safety Council (MHSC) has established Milestones aimed at the reduction of equipment noise emissions and ultimately eliminating noise induced hearing loss (NIHL):

Manufacturer's and supplier's duty for health and safety as stipulated in Section 21 the MINE HEALTH AND SAFETY ACT (ACT 29 of 1996)

By December 2034, the noise emitted by individual pieces of equipment operated by employees and individual process equipment should not exceed a milestone sound pressure level of 104 dB(A). Using current diagnostic methods, by December 2034, there should be no novice cases of noise-induced hearing loss amongst previously unexposed individuals. ("Previously unexposed individual" are those unexposed to occupational noise prior to December 2024 i.e., Equivalent to a new person who entered the industry in January 2025)

Manufacturer's and supplier's duty for health and safety as stipulated in Section 21 the MINE HEALTH AND SAFETY ACT (ACT 29 of 1996)

(1) Any person who-

(a) designs, manufactures, repairs, imports or supplies any article for use at a mine must ensure, as far as reasonably practicable-

(i) that the article is safe and without risk to health and safety when used properly; and

Purpose

Equipment noise emissions has been identified as a significant occupational risk within the South African Mining Industry. In order to effectively manage the noise hazard, it is imperative to have a strategy aimed at the elimination and control of noise at source through the implementation of an accepted, practical and effective "Buy and Maintain Quiet" Initiative. The noise emission of equipment forms the basis of the "Buy and Maintain Quiet" Initiative, with the appropriate noise measurement methodology playing a pivotal role in this regard and emphasises the importance of accurate noise emission data of equipment. This document is aimed at providing guidance on the application of uniform measurement procedures under realistic operating conditions and allow for the equipment noise emissions reported to be representative and comparable. This Guide can be applied by operations when engaging manufacturers, suppliers and repairers on their procurement strategies, contractor's packs, or when going out on tenders.

1. NOISE MEASUREMENT OF EQUIPMENT AND MACHINERY

1. General requirements

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

- Confirm the Integrating Sound Level Meter (ISLM's) acoustic sensitivity with a sound calibrator immediately before and after each series of measurements, usually before commencing each set of measurements and immediately after completion of the set of measurements. 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.
- 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.
- 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; and
    c. be accredited by a recognised accreditor.

2. 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 ISLM 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}.

3. Measurement criteria

Noise levels should be measured directly with an integrating sound level meter (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 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.
The following measurement criteria should be applied:

- Occupational exposure limit: 85 dBA
- Threshold level/low threshold limit: None/Off
- Energy exchange or doubling rate: 3 dBA

The instrument supplier or calibration laboratory 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 onboard software or firmware, the criteria listed above should be confirmed or corrected using the instrument's set-up mode.

4. Measurement procedures

Measure $L_{Aeq,\,T}$ for a representative time at a selected microphone position:
All noise measurements conducted must comply with the requirements stipulated in SANS 10083 and ISO 3744/SANS3744.

Ensure (as far as practicable) 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 is not possible, the background noise level should be recorded in the equipment noise emission report.

Where it is not possible to evaluate the equipment within the underground working environment, the impact of the noise emitted from a piece of equipment within the underground working environment can be estimated by the doubling of the sound pressure level measured on surface. This is achieved by adding 3 dBA to the noise emission level measured in a surface environment, to allow for sound reflected from solid boundaries (reverberation). Noise measurements should be taken 1m away from the specific piece of equipment being evaluated, as far as reasonably practicable.

For steady noise, a measurement duration of at least 5 minutes would be considered as adequate.

Where the noise varies or is cyclical, the measurement time should be sufficient to capture all the variations in noise level over the full working cycle and include a reasonable number of work cycles (at least three cycles), to ensure the representativeness of the measurement 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.

Where practicable, ensure that the microphone is at the height stipulated below under items a) and b), at least 1,2 m away from walls and other large flat surfaces and 1,0m from the equipment under evaluation. Select at least three positions that are well distributed around the piece of equipment under evaluation and use the following microphone heights and take measurements at each position:

a. for standing persons: 1,5 m above the floor or ground on which the persons are standing;
b. for seated persons: 0,9 m 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 must be precisely stated in the test report (distance of the measurement position from the operator position and microphone direction indicated on the sketch)

- Measurements conducted on vehicles should include measurements inside the operator cabin as well as measurements outside the operator cabin and should conform with the requirements specified in the general requirements and measurement procedures sections.

5. Manufacturer/ Supplier equipment noise reports

- Each user of equipment should ensure that an equipment noise emission report which complies with the requirements specified in this document is provided on delivery of each item procured, serviced or refurbished.

The following information must be recorded and stipulated in the equipment noise emission report:

- Integrating Sound Level Meter information, consisting of the following minimum information:
  - » Instrument type (including make and model), instrument serial number, microphone serial number, SANAS calibration information (date, certificate number, service provider / laboratory information, etc.)
  - » Environmental, equipment information and evaluation results, consisting of the following minimum information:

- Supplier/ Original Equipment Manufacturer Name
- Division of Company
- Type of equipment – name and description
- Equipment Model
- Serial/ equipment number
- Details of equipment operation during noise evaluation, considering all possible intended uses
- Power source and power rating (e.g. pneumatic/ electric/ electro-hydraulic/ hydro power)
- Description of the acoustical environment and the environmental conditions in which the equipment noise evaluation was conducted
- Noise Measurement duration/ period per measurement
- Noise level (dBA) – (all scenarios/ cycles to be recorded and listed).

- Noise level ($L_{Aeq,\ T}$ dBA) – (log average to be recorded for all scenarios)
- Background noise levels and background noise sources list
- A dimensioned drawing or sketch of the area where the equipment noise measurements were conducted, with the measurement positions/ locations indicated
- Compressed air\ water pressure during the conducting of the equipment noise evaluation - for pneumatic/ hydro equipment
- Date and time of the equipment noise evaluation and report no
- Details of the competent person (including but not limited to: name, qualifications, experience, certification.)
- Equipment maintenance interval requirements, based on noise emission.

2. 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 basic steps to follow when performing noise measurement on an identified piece of equipment:

01 Identify the equipment to be measured and note the details of the equipment (Manufacturer, Equipment Type, Model, etc.)

02 Determine the background noise level present in the area to be measured. Define the distance the background noise equipment is away from the equipment to be measured e.g. 6m away.

03 Identify which equipment or activities can be safely stopped or switched off for the noise measurement duration.

04 Isolate the equipment and activities identified in step 3 above, where required.

05 Conduct background noise measurements.

06 Record the background noise level present, together with the relevant information on the equipment and/or activities which could not be isolated.

07 Conduct noise measurements according to the measurement procedures stipulated within Section 4 of the Guidance Note for 3rd Party Equipment Noise Verification Measurement. 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.

08 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.

09 Record all the other relevant information, as specified in the Manufacturer/Supplier Equipment Noise Reports in Section 5 of this Guidance Note. The report should also indicate the microphone positions in relation to the equipment and surroundings evaluated, for future reference.

REFERENCES

- **SANS/IEC 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
- **ISO11200:2014** – Acoustics – Noise emitted by machinery and equipment – Guidelines for the use of basic standards for the determination of emission sound pressure levels at a workstation and at other specified positions
- **Mine Health & Safety Act** - Act 29 of 1996
- **SANS/IEC 61672-1** – Electro-acoustics – Sound level meters Part 1: Specifications
- **SANS/IEC 60942** – Electro-acoustics – Sound calibrators
- **SANS 10083** – The measurement and assessment of occupational noise for hearing conservation purposes
- **SANS 1470-4** – Sound Power Labelling – Pneumatic Equipment

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