Guidelines and Standards for Speech-Language Therapists and Audiologists:

Hearing Conservation in Industries
Standards and Guidelines for Speech-Language Therapists working in Hearing Conservation in Industries

Introduction

These guidelines express SASLHA’s position regarding the audiologist role in hearing conservation. For the purpose of this discussion “hearing conservation in industries” is defined as the prevention of significant, permanent hearing loss resulting from on-the-job exposure to ototraumatic agents (e.g. noise) in industries.

These guidelines have been formulated to offer guidance to audiologists, related professionals, and consumers of occupational hearing conservation services in the following areas:

- role of the audiologist in providing hearing conservation in industries
- components of service delivery in hearing conservation in industries
- professional ethics related to service delivery in hearing conservation

Key concepts and definitions (according to SANS 10083:2004)

1. Audiogram:
   A chart, graph or table indicating the hearing levels of an individual as a function of frequency at 0.5, 1, 2, 3, 4, 6 and 8 kHz for pure tone audiometric testing.

2. Competent Person (referred to as audiometrist or audiologist):
   - Audiologist – graduate in speech therapy and audiology registered with the Health Professions Council of South Africa as:
     a. A medical specialist in otorhinolaryngology (ear, nose and throat specialist), or
     b. A graduate in speech therapy and audiology
   - Audiometrist – a person registered with the Health Professions Council of South Africa as an audiometrist or a hearing aid acoustician, or one of the following persons:
     a. A medical specialist in otorhinolaryngology (ear, nose and throat specialist), or
     b. A graduate in speech therapy and audiology, or
     c. A person who holds a certificate in audiometry issued by an institution recognized and approved by the Department of Labour or by the Department of Minerals and Energy, as relevant, or
d. An occupational medical practitioner, or a person qualified in audiometric techniques from an institution registered with the South African Qualification Authority or any of its structures in terms of the South African Qualifications Authority Act, 1995 (Act No.58 of 1995), and registered with the South African Society for Occupational Health Nursing (SASOHN).

3. **Excessive Noise:**
   Noise that equals or exceeds 85dBA

4. **Percentage Loss of Hearing (PLH):**
   Measure of the loss of hearing determined in accordance with Annex E of the SANS 10083:2004 Edition 5. Using the hearing levels determined by the baseline, periodic screening, exit or diagnostic audiometry (as applicable);
   Determine the contribution for the different frequencies, to the PLH from the hearing levels at the frequencies of 0.5 kHz, 1 kHz, 2 kHz, 3 kHz and 4 kHz using the approved frequency specific tables as supplied.
   Sum the individual PLH values for the individual stated frequencies to determine the final PLH (Refer to supplementary Excel document for calculator).

5. **Baseline Audiometry: existing employee**
   Pure tone air conduction audiogram and an otoscopic examination obtained from an existing employee as required by the relevant legislation. The audiometric results will serve as a reference for all future decisions regarding the hearing acuity of that employee and will form part of his/her service and medical surveillance record.

6. **Baseline Audiometry: new employee**
   Pure tone air conduction audiogram and an otoscopic examination obtained from an existing employee as required by this standard and conducted by an audiologist before, or within 30 days of commencement of working in a noise zone. The audiometric results will serve as a reference for all future decisions regarding the hearing acuity of that employee and will form part of his/her service and medical surveillance record.

7. **Diagnostic Audiology:**
   Advanced psychoacoustic and electrophysiologic assessment of auditory response as required in terms of this standard and conducted by an audiologist. Although the pure tone audiogram provides information of value in the determination of the nature and cause of the auditory disorder, the term diagnostic audiology refers to specialized procedures beyond the conventional pure tone and speech tests used to quantify a hearing loss. Diagnostic audiology is used to identify the site of the lesion in the auditory system.
8. **Ear-muff**
   Hearing protector that occludes the ears

9. **Ear-plug**
   Hearing protector that is inserted and worn in the ear canal or in the ear cavity or occludes the entrance to the external ear canal.

10. **Exit audiometry**
    Pure tone air conduction audiogram and an otoscopic examination obtained from an employee at the end of employment in a noise zone. These results form part of the employee’s medical surveillance records and should be retained.

11. **Hearing conservation**
    The implementation of hearing conservation procedures and control of noise through engineering methods in order to prevent or minimize noise-induced hearing impairment.

12. **Hearing conservation program**
    The program aimed at the prevention of noise-induced hearing impairment involving the implementation of the following:
    - Assessment and prediction of noise exposure in all workplaces
    - The reduction of the 8 h rating level where this is expected to exceed the noise rating limit for hearing conservation
    - The introduction of a prohibition to persons entering such a workplace unless such a person is adequately protected
    - The introduction of a medical surveillance program for all employees working in such workplaces
    
    A well-planned program grounded in medical concern for employee health and rich in educational groundwork is likely to succeed. Every hearing conservation program, even in a small plant, requires teamwork. The team consists of the medical, hygiene, and safety departments, management, supervisors and labor representatives.

13. **Noise rating limit for hearing conservation**
    Value of the 8 hour rating level (85 dBA) at and above which hearing impairment is likely to result.

14. **Noise zone**
    Area within which the noise equals or exceeds the noise rating limit for hearing conservation.

15. **Periodic screening audiometry**
An otoscopic examination and pure tone air conduction audiogram, obtained on a periodic basis to determine if an employee presents with a permanent shift in the hearing level, for conservation purposes.

16. **Permanent threshold shift**
Shift in the hearing level from the normal to which the hearing level restores after the exposure to noise is stopped for an extended period of time (normally 16 hours or more)

17. **Referral threshold shift**
Deviation or a change for the worse of the hearing level obtained from the results of base line audiometry

18. **Conditions for compensation consideration:**
Employees whose PLH:
- shows a shift of more than 10% from the baseline audiogram
- exceeds 10% where no baseline is available
Existing employees whose baseline result shows a Percentage Binaural Impairment in excess of 1.7%.

**Relevant legislation**


**IEC 60645-2,** Audiometers – Part 2: Equipment for speech audiometry,

**SANS 10083:2004,** (In revision) The measurement and assessment of occupational noise for hearing conservation purposes

**SANS 1451-1,** Hearing protectors-Part 1: Ear-muffs

**SANS 1451-2,** Hearing protectors-Part 2: Ear-plugs

**SANS 1451-3,** Hearing protectors-Part 3: Ear-muffs attached to an industrial safety helmet

**SANS 10103,** The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication

**SANS 10154-1,** Calibration of pure-tone audiometers – Part 1 : Air conduction

**SANS 10154-2,** Calibration of pure-tone audiometers – Part 1 : Air conduction

**SANS 10182,** Obtaining an acoustic environment suitable for testing
Contexts of practice

Premises as defined in the relevant Health and Safety legislation, such as factory areas, industrial working areas, driver’s cabins of vehicles, and operator’s positions for machinery and equipment etc.

Role and responsibility

The roles and responsibilities of the industrial audiologist include the following:

- Audiometric testing, audiogram review and follow-up steps, including referral as needed;
- Personal hearing protection, including its selection, user fitting and training, and supervised use;
- Education and motivation of management and workers
- Recordkeeping
- Analysis of program effectiveness

Tasks

Industrial audiometric assessments

The cost of the industrial audiometric assessment is the responsibility of the company and not of the employee’s medical aid.

Baseline Audiogram:

- Should be conducted on all existing employees expected to enter a noise zone at the work place and for whom a valid baseline result has not yet been determined
- Should be conducted on all prospective employees of whom it would be expected to enter a noise zone and for whom a valid baseline result, in terms of the relevant legislation, has not been previously determined.
- Obtained from an audiometric assessment performed prior to employment or within 30 days of commencement of employment.
- Testing can only be conducted after 16 hours out of noise.
- Wearing ear protection whilst in a noisy environment will not meet this requirement.
- The test frequencies include 0.5, 1, 2, 3, and 4 kHz.
- All subsequent audiograms will be compared to this to determine deterioration in percentage loss of hearing (PLH).
- The baseline audiogram of an employee applies to that employee’s baseline for his total working career and must be recorded and kept for a period of 40 years. When an employee changes companies, the baseline as well as the most recent audiogram with the PLH as calculated according to Instruction 171, must be presented at commencement of employment to the new employer.
- At the time of the assessment the employee should be positively identified by means of photographic identification (driver’s license, identity document).
- Before testing, an otoscopic examination should be conducted to ensure no visible abnormalities. The employee’s ears should be checked for wax and if occlusive wax is present, this should be removed by a medical practitioner. Audiometric assessment must be delayed for three days following this procedure.
- 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 can have an effect on the hearing.
- The baseline should be the better of two initial screening audiograms performed on the same day provided the two audiograms do not differ by more than 10dB at any of the test frequencies.
- The PLH is calculated using the tables in SANS 10083:2004
- All subsequent audiograms are compared to this audiogram to determine deterioration in percentage hearing loss (PLH).
- Employees whose Percentage Binaural Impairment (PBI) exceeds 1,7% could be considered for compensation purposes.
- No referral for compensation should be made on the basis of a baseline audiogram. The baseline results should be used to determine any future compensable loss sustained in terms of the relevant legislation.
- A copy of the baseline audiogram and employee’s service record should accompany any referral for diagnostic audiometry.
- Where no previous baseline test was conducted before the due date, the baseline should be recorded as 1,1%.
Periodic/Monitoring Audiometry:

- The same process is followed as for baseline audiometry.
- The period between routine testing should not exceed one or two years. This is reduced when exposed to gunshots.
- A shift of more than 10% in the PLH from the Baseline result would require further diagnostic audiometric examination by an audiologist.
- Should the diagnostic result confirm a shift of more than 10% in the PLH from the Baseline results, the test date should be regarded as the date of commencement of the disease.
- The employee should be referred for a medical opinion either to:
  1. an ENT specialist if the shift in the PLH is in excess of 30% or if the case is complicated
  2. an occupational medical practitioner if the shift in the PLH is 30% or less or if the case is uncomplicated
- Compare the routine screening results with relevant previous audiometry results including the baseline.
- Where a referral threshold shift is detected, the employee should be provided with training and information regarding hearing conservation.
- Any employee showing a referral threshold shift should be tested annually for a period of three years before biennial testing may be considered for that employee.

Diagnostic Audiometry:

- Diagnostic audiometry should adhere to the HPCSA guidelines for Standards in Audiology.
- Diagnostic audiometry should be performed by an audiologist to determine compensable hearing loss.
- Diagnostic audiometry consists of two diagnostic audiograms performed after at least 24 hours have elapsed from the last exposure to excessive noise.
- Audiograms may be done on the same day but at different sittings.
- The better audiogram is used to calculate the PLH.
- Audiograms may not differ by more than 10dB at any of the test frequencies. If there is a greater difference, a third audiogram must be conducted.
- If inconsistency persists, further assessment should be delayed for a period of six months. If after six months the audiograms are inconsistent, referral to an Ear, Nose and Throat (ENT) specialist to determine the loss (if any) is recommended.
The employee should be referred for a medical opinion from an ENT specialist in complicated cases (where the nature of the hearing loss is unclear or requires further medical investigation).

- PLH > 30% from the baseline, refer for ENT opinion.
- PLH < 30% from the baseline, refer to an Occupational Medical Practitioner.
- Employees whose hearing has deteriorated more than 10% from the baseline should be referred for compensation.

The actual referral remains the responsibility of the employer but could be handled on his behalf by the audiologist.

At least the following investigations should be done by the audiologist during the diagnostic testing:
- an otoscopic examination
- a diagnostic test in accordance with the relevant legislation to calculate the PLH
- a pure tone air conduction test at least at 0.5, 1, 2, 3, 4, 6, and 8 kHz
- a bone conduction test at least at the above frequencies
- a speech reception threshold
- a speech discrimination test
- a full immittance test battery including tympanometry, ipsi- and contra-lateral acoustic reflex testing
- otoacoustic emissions testing including transient otoacoustic emissions and/or distortion product emission testing (or both) if available;
- any other audiometric test procedure to determine degree of hearing loss that could be ascribed to noise exposure; and
- in the final conclusions from the test results, due consideration should be given to the complete medical history, including information obtained from the employer. A clear analysis is required as to the contribution of noise exposure to the hearing loss of the employee.

Exit Audiometry:
- This should be performed by an audiometrist (see definition) at the conclusion of employment or when the employee is permanently transferring out of a noise zone.
- The same process is followed as for baseline audiometry.
• If a deterioration of more than 10% relative to the baseline audiogram and confirmed by repeated audiometry referral for diagnostic audiometry should be made.

**Recording Information and recordkeeping**

Information recorded or apparent in the records of baseline, periodic and diagnostic audiograms and submitted must include:

- Employee’s name, identity number, company or work identification number and age.
- Nature of individual’s work and date of employment.
- Details of observed noise levels and noise exposure levels relevant to individual or to his/her occupation or workplace, including such levels relevant to previous allocations and period worked in each occupation or workplace.
- Name, address, qualification and registration number of person conducting the audiometry.
- A complete medical record of the employee.
- Employee’s baseline audiometric data and the PLH derived from it.
- Employee’s current hearing threshold levels and PLH derived from it.
- Results from the diagnostic hearing assessment.
- Relevant comments regarding employee’s response to testing.
- Details of any differences found between baseline and current audiograms.
- Details of actions taken.
- Copies of any medical opinions obtained and names and addresses of individuals providing such medical opinions.
- Signature of the audiologist.
- Full specifications of the hearing protectors which were used by the employee.
- Proof of employee’s identity – the audiologist performing the testing should acknowledge this in writing.

Reports written as a result of this testing are legal documents and should adhere to the HPCSA rules and regulations on record keeping.

**Education and motivation of management and employees.**

Education of management and employees is critical to development and acceptance of a hearing conservation programme. Hearing conservation should be promoted through employee orientation, job instruction, training, and poster exhibits of hearing protection
devices and safety talks. Signs should be posted at entrances to high-noise areas warning of the hazard and directing employees to wear hearing protectors.

When planning hearing conservation education the following aspects must be kept in mind:

- Management, supervisors and employees should be exposed to a comprehensive education programme on the ear, its function, possibilities of damage, preventative measures and corrective measures if damage exists or if unusual deterioration is detected during employment.

- Any employee who is exposed to noise that exceeds the maximum advisable levels should be required to wear hearing protection devices. In order to obtain the compulsory utilization of such devices, the programme will require cooperation and the very best levels of understanding between management, employees and supervisors.

To ensure this, the following education programme is recommended for all the role-players in the industry:

- Schedule a special conference for management to explain applicable laws, regulations, company philosophy and plans for controlling noise and also for hearing conservation.
- Schedule a similar conference for first and second level supervisors. All management and supervisory personnel should be fitted with hearing Protection; distribute available educational literature, a list of questions and answers, and announce plans.
- Schedule a 45-minute employee meeting with appropriate plant management in charge. Outline the basic steps of the programme, enforcement and replacing policies, and general descriptions of caring for and replacing protectors.
- Distribute educational literature.
- Explain hearing testing.
- Issue protective devices in areas of excessive noise, put signs in designated noisy areas (noise zones) and place educational posters where necessary.

**Minimum requirements to perform the tasks**
(facility, equipment, information technology, infrastructure)

**Competent individual**
As explained in Key Concepts and Definitions

**Test environment**

A room or a mobile unit that complies with the provisions of SANS 10182 for screening or diagnostic eudiometry, as relevant.

Suitability of the test environment should be assessed before initial use and thereafter at intervals not exceeding one year.

**Audiometric equipment**

Measuring equipment for baseline, periodic screening and exit audiometry:

Use an audiometer that complies with the requirements for a type 4 audiometer specified in IEC 60645-1 with the additional frequency of 8 kHz for which a value of hearing level of at least 70dB applies.

Measuring equipment for diagnostic audiology:

- A diagnostic audiometer that complies with at least the requirements for a type 3 audiometer specified in IEC 60645-1 and speech audiometric equipment.
- Immittance audiometric equipment that is capable of performing Tympanometry and acoustic reflex testing
- Otoacoustic emissions equipment that is capable of performing transient otoacoustic emission testing or distortion otoacoustic emission testing
- It is recommended that any other equipment should be available as necessary in order to diagnose the presence of noise-induced hearing loss, such as auditory brainstem response evaluation.

**Maintenance and calibration of audiometric equipment:**

Correct calibration of audiometric and related equipment is essential for reliable test results. Before its initial use, calibrate the audiometric equipment in accordance with the relevant legislation on the site where it is to be used and in its operating position. Carry out routine checks on each day of use and at weekly intervals. If no deviations or defects are observed during routine checks, calibrate as above at intervals not exceeding one year.

Mobile audiometric facilities and audiometers intended to be used in different locations should be calibrated and maintained in accordance with annex A of SANS 10154-1:2000.
The calibrating laboratory /organization should issue a calibration certificate of compliance in accordance with the legislation.

**Other relevant issues**

**Ethical aspects related to service delivery in industrial hearing conservation**

The SASLHA’s Code of Ethics sets forth fundamental principles and rules considered essential to preserve the highest standards for integrity and ethical principles as this is vital to the responsible discharge of obligations in the profession of Audiology. It contains several principles and rules that are especially relevant to the provision of hearing conservation in industries.

**Resources** (internet links, documents)


http://www.hearingconservation.org

http://www.cdc.gov/niosh/topics/noise/

**Key references**


SANS 10083:2004, *(In revision)* The measurement and assessment of occupational noise for hearing conservation purposes