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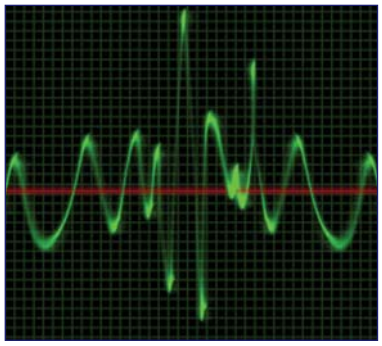

Guidelines on Hearing Checks and Audiometry Under the Safety, Health and Welfare at Work (General Application) Regulations 2007, Control of Noise at Work

CONTENTS

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1 Hearing Checks and Screening Audiometry

1.1 BACKGROUND AND DESCRIPTION

These guidelines are to assist registered medical practitioners, and/or persons ***'acting on his or her responsibility'***, in carrying out "hearing checks" in those employees exposed above the ***upper exposure action value*** and also to assist in "preventative audiometric testing" in those exposed above the ***lower exposure action value*** as required by the *Safety, Health and Welfare at Work (General Application) Regulations 2007, Control of Noise at Work.* Throughout the text, these will be referred to as ***'the Regulations'.*** They are also intended to inform employers and employees of the principles of industrial audiometry. The essential difference between a "hearing check" and "preventative audiometric testing" is that the former involves a more complete assessment including an examination including otoscopy (see 1.4 below). It is important to remember that the Regulations apply minimum standards and it is of course possible to provide "hearing checks" to all employees.

Noise in the workplace is almost never constant, even when it appears to be so, as the person at work is often moving. In order to make variable noise sensible, we use the Leq or equivalent constant noise level over a defined period of time that is of equal energy to the variable noise. In other words this is an average noise level over a period of time.

The Regulations refer to the "**daily noise exposure level"** ($L_{EX,\ 8h}$) (dB) (A) re: 20 μPa). This means the time-weighted average of the noise exposure level for a nominal eight-hour working day as defined by international standard ISO 1999: 1990 point 3.6. It covers all noises present at work, including impulsive noise. This corresponds to the Lepd referred to in previous legislation.

High noise levels, even if they are instantaneous can be dangerous and so the Regulations also refer to Peak levels which if exceeded at any time are covered by the requirements of the Regulations.

Regulation 123 refers to an ***exposure limit value*** and two ***action levels***.

exposure limit values: $L_{EX,8h}$ = 87 dB(A) and P_{peak} = 140dB(C) in relation to 20 μPa.

upper exposure action values: $L_{EX,8h}$ = 85 dB(A) and P_{peak} = 137dB(C) in relation to 20 μPa.

lower exposure action values: $L_{EX,8h}$ = 80 dB(A) and P_{peak} = 135dB(C) in relation to 20 μPa.

Each value requires specified action to reduce noise risk, detailed in the Regulations. The ***exposure limit values*** but **not** the ***exposure action values*** can take into consideration the person's effective noise exposure by consideration of the attenuation afforded by hearing defenders.

Regulation 123 allows the use of a weekly average in certain circumstances:

> *"For activities where the daily noise exposure varies markedly from one working day to the next, an employer, for the purposes of applying the exposure limit values and the exposure action values, may use the weekly noise exposure level in place of the daily noise exposure level to assess the levels of noise to which the employers' employees are exposed, provided that -*
>
> *(a) the weekly noise exposure level as shown by adequate monitoring does not exceed the exposure limit value of 87db(A), and*
>
> *(b) appropriate measures are taken in order to reduce the risk associated with these activities to a minimum."*

'Screening' and 'Diagnostic' Audiometry

This document, unless otherwise stated, refers to workplace Screening Audiometry (the audiometric element of a hearing check) or 'screening' - which involves only an assessment of the hearing thresholds using air conduction under headphones, with testing carried out under specified conditions and by certain methods, given in ISO 6189:1983.

Screening Audiometry alone cannot be used to classify hearing loss as outer/middle ear (=conductive hearing loss, CHL), inner ear/nerve (=sensori-neural hearing loss, SNHL), or a mixture of both (mixed hearing loss, MHL).

Noise-induced hearing loss (NIHL) is an inner ear loss, caused mainly by damage to hair cells in certain regions of the cochlea, resulting in SNHL. That is, NIHL is a form of sensori-neural or "nerve" hearing loss. Screening Audiometry cannot be the sole basis for advising someone that a particular noise exposure has caused their hearing loss. The question of diagnosis and referral is further detailed below.

Regulation 131 requires the employer to make available to employees health surveillance including "hearing checks" and "preventive audiometric testing" when workplace noise levels cannot be reduced below the ***lower exposure action level*****.** Where employees are liable to be exposed to noise above the ***lower exposure action level****,* the employer in consultation with his/her employees must carry out a risk assessment. Where the risk assessment indicates exposure above the ***upper exposure action level****,* the employer must make available the services of a registered medical practitioner (RMP) to carry out or have carried out on his or her responsibility a hearing check. Where exposure exceeds the ***lower exposure action level***, the employer must make available to employees preventive audiometric testing. Hearing checks and preventive audiometric testing are currently optional to the worker (see 1.5).

It is recommended that the registered medical practitioner (RMP) should be a competent person by means of his or her training, experience, knowledge and or qualifications. Ideally the RMP should have a qualification in occupational medicine but this is not always possible. Preventive audiometric testing can be carried out by an occupational health professional such as an occupational health nurse or audiologist. It is recommended that this healthcare practitioner should be a competent person by means of his or her training, experience and or qualifications. Ideally the healthcare practitioner should have a qualification in occupational health and or a qualification in industrial audiometry and preferably both.

There are many causes of hearing loss, noise is but one. The pattern of an Audiogram

may suggest NIHL, however a firm diagnosis can rarely be made without further information, the scope of which is beyond these guidelines. The purpose of Workplace Screening Audiometry is not to diagnose in itself but rather identify those who might have a problem to allow for appropriate further action which may include referral to allow for diagnosis.

It is also important to remember that even NIHL can be caused by social, accidental as well as being due to workplace exposure to noise, and it may be accelerated by other genetic, health and lifestyle factors.

Further information about 'diagnostic audiometry' and NIHL is available in the Green Book, 'Hearing Disability Assessment', published by Department of Health & Children in 1998.

1.2 AUDIOMETRIC CHARACTERISTICS OF NOISE-INDUCED HEARING LOSS

NIHL typically results in a "V" or "U" shaped 'notch' often starting around 4000 Hz (4 kHz), but sometimes 6000 Hz (6 kHz), then gradually deepening and later spreading to adjacent frequency ranges. There is typically "recovery" or improvement at 8000 Hz or 8 kHz. This is the classical difference between the pattern of NIHL and that of Presbyacusis (hearing loss of advancing age) where there is usually a further drop at 8 kHz. This difference may become less marked with time and or increasing severity and indeed deciding on whether a hearing loss is noise induced or due to Presbyacusis, or a combination, can be quite difficult.

Human speech is predominantly in the range 500 to 3000 Hz. The frequencies 4 kHz, 6 kHz and 8 kHz are above this and are referred in audiometric terms as "high frequencies". Any hearing loss predominantly affecting these frequencies is termed High Frequency Hearing Loss. NIHL is an example of this.

In NIHL, both ears are normally affected more or less equally. Sometimes if there is a marked difference in noise dose between the ears they may be asymmetrical. In this case the ear nearest the noise source receiving the larger dose, due to 'head shadow' effects, is the most severely affected. The most common example of this is shooting where for a person shooting off the right shoulder; the left ear is more affected. This is because the noise comes from the barrel of the gun and as the head is turned to aim, the right ear is somewhat protected by the head.

In about half of all cases of significant hearing loss, some increase in the frequency of buzzing or ringing in the affected ear(s) will occur: i.e. Noise-Induced Tinnitus (NIT). In many cases of early NIHL, there is no damage to frequencies at or below 2 kHz.

Permanent damage to the ears is often preceded by periods of Temporary Threshold Shift, (TTS).Unlike NIHL, TTS is reversible. It usually occurs after exposure to loud noise and has been experienced by most people after a disco, concert or something similar. The person is often conscious of diminished hearing and this is often accompanied by Tinnitus. This diminishes with time. The effect can last up to 48 hours but the vast majority has reversed in 16 hours. This effect is of importance in the event of performing a hearing test if the employee has been exposed to loud noise in the last 16 hours. Whether this is as a result of loud music socially or occupational noise does not matter as it still has the potential to affect the result of the test.

Instantaneous noise, which is not physically painful, is unlikely to produce permanent NIHL, unless repeated many times over. If recurrent instantaneous noise exposure continues at high levels for many years (or if it is explosively or painfully loud, and repetitive over short periods), the hearing loss can begin to affect 2 kHz and lower frequencies, and cause significant hearing loss.

Hearing damage due to noise occurs at the time of exposure or within a very short time thereafter. Once the person is removed from the loud noise environment, NIHL will not progress further as a result of that noise. Noise damage is not progressive without more noise. This is an important point because, for example, if an audiogram shows a significant deterioration from the previous test and there has not been significant occupational noise exposure in the interim, the loss **cannot** be occupational.

Pre-employment audiometry can enable pre-existing notches (or other hearing problems) to be detected. Early NIHL will only cause slight difficulty in certain listening environments like noisy crowds or large groups. Many people with mild, slowly progressive high frequency hearing loss are unaware of gradual hearing changes. Having existing hearing loss should not be used as an automatic reason for exclusion from a noisy workplace - some hearing losses (particularly Conductive) may even reduce the susceptibility to NIHL. It is important for the employer to be aware of their responsibilities under Equality Legislation as well as Health and Safety Legislation. In general the questions which need to be answered are:

- ▲ Can this person do the job?
- ▲ Can this person be safe in this working environment? e.g. fire alarms, adequate hearing defenders.
- ▲ Are there any special precautions, adaptations necessary to allow this person to do the job safely? e.g. visible alarms, vibrating alarms.
- ▲ Are there special measures needed for continued monitoring of this person?

1.3 PRINCIPLES OF AUDIOMETRY

An audiometer gives calibrated noise signals of variable intensity, at different frequencies ranging between 250Hz or 500Hz, up to 8 kHz, into the headphones used for testing hearing. Audiometry should be conducted according to ISO 6189.

The person's response to a 'barely audible' tone forms the basis of the test, so it is 'subjective'; this can be unsatisfactory if he/she is not participating fully -either because of inadequate instructions, noisy conditions, inattention or medico-legal factors affecting test compliance.

A suitably soundproofed setting must be provided for testing. Persons must be correctly instructed and monitored during the test to ensure continued attention and compliance. Many audiometers have a facility for talking via microphone and headphones to the person in the test booth. This should be used if responses to audiometric tones seem exceptionally poor or are inconsistent.

1.4 OBJECTIVES OF HEARING CHECKS AND AUDIOMETRY

Regulation 131 states that the purpose of hearing checks and audiometric tests carried out as part of health surveillance is to provide early diagnosis of any hearing loss due to noise and to assist in the preservation of hearing of employees.

The "hearing check" requires:

(a) Taking of a medical history of the worker, with particular reference to ear problems and existing ear protection use.

(b) Examination of the external auditory canal and the tympanic membrane.

(c) The (audiometric) screening test.

"Preventive audiometric testing " strictly involves the audiometric screening test only, although it is vital to appreciate that the audiogram is very much less benefit on it's own and while the Regulations set down minimum standards, many employers will choose to perform "hearing checks" on all noise exposed employees.

The purpose of these hearing checks is primarily the identification of possible early NIHL. This is to allow prevention of further progression (at work) - by reducing the level of noise exposure through changes in equipment noise levels, ear protection or physical ergonomic aspects of the work. An ongoing screening program may permit the identification of a small percentage of workers at high risk of NIHL who need extra ear protection or who on **very** rare occasions may need to be removed from the workplace. The element of education to reduce the risk of NIHL, which the screening setting affords, is also important.

Screening Audiometry carried out prior to employment, called a BASELINE audiogram, is invaluable in establishing if subsequent audiograms show recently acquired hearing loss. The history taken at this BASELINE stage may be very important.

If subsequent audiograms show deterioration in several workers, it may indicate the need for additional measures (e.g. noise reduction or increased ear protection/instruction) in particular areas of the workplace. However, if only one or two workers show deterioration in audiometry, other possibilities need to be considered. Whilst the Regulations specify hearing levels, or changes which merit further investigation, through referral of an individual to a specialist, this will usually not result in recommendations at the 'workplace' level. The employer will also need to consider if extra measures are advisable in the light of trends from their Audiometric Screening Programme results as a whole.

1.5 OPTIONAL TO THE WORKER

Where hearing checks and preventive audiometric testing are made available by the employer, workers may avail of them if they wish, but they may choose not to have them. Employers need to consider the relative risk of NIHL in their workplace; by having suitable noise surveys carried out, and decide whether to make the checks 'available' or a 'condition of employment'. Detailed noise surveys (looking at various areas of the workplace) should be available to the person conducting hearing checks if requested.

2 Technical Requirements

2.1 TESTING FACILITIES

The most comprehensive audiogram is usually performed by an experienced audiologist in a hospital or other ideal testing facility. In those circumstances it will often be accompanied by other valuable tests such as Otoacoustic emissions. Such testing however is not practical or necessary for health surveillance of employees under the Regulations but may be requested by the RMP to aid in diagnosis.

While it is appreciated that industrial audiograms can not always be performed in absolutely ideal conditions nevertheless Screening Audiometry must be carried out in a quiet environment, as specified in ISO 6189. Therefore the proposed test setting is analysed using a 'third-octave band noise analysis' and also for possible sources of intermittent noise interference, unless a simple sound level meter shows that the setting has ambient noise levels continuously below 30dB(A). This is rarely achieved without an audiometric soundproofed booth.

The booth needs to be sited in a quiet place away from traffic or intermittent noise sources. The suppliers of the soundproofed booth will provide advice on situating the booth, an initial calibration certificate, and a regular inspection/calibration certificate to ensure that the sound environment continues to be satisfactory.

Most audiometers used for workplace screening are supplied with 'Audiocups' or MX41/AR cushions, which exclude more noise than standard TDH39 headphones. When these are fitted to the audiometer, the additional attenuation supplied can be subtracted from the ambient noise level in the booth to obtain the actual 'test environment' level. This is also explained in ISO 6189. Suppliers of audiometers can advise on the use of headphones. Once calibrated, headphones must remain with that audiometer - they cannot be changed without re-calibration.

2.2 CALIBRATION

Suppliers of audiometric booths and audiometers will generally offer calibration services for their equipment. Audiometric booths should be certified regularly (at least once every 2 years) depending on the use and conditions - a certificate of compliance can be issued and kept with the booth for inspection by the Authority. Audiometers require more frequent calibration - at least annually - more often if the machinery is moved or frequently used. Calibration certificates should be kept conveniently for reference.

Calibration ensures consistency of test settings so that audiograms carried out in different companies/workplaces can be compared directly, and compliance with ISO 389 (also available from www.iso.ch).

In addition to certified calibration, the audiometer operator should inspect equipment at the start of every day that it is in use, for visual or audible faults such as: loose plugs, damaged cables, intermittent sound, noisy switching mechanisms, or changes in sound quality. These can be detected by the operator checking tones at or above their own hearing thresholds at various test frequencies. Thresholds should not vary without obvious reason, between usages.

The operator should record their own hearing thresholds (using automatic audiometry) in the soundproof booth at intervals, as a check on calibration, and remind themselves of the nature of the experience, and become more aware of possible sources of interference which might exist.

2.3 PREPARATION OF EMPLOYEE

2.3.1 Employees need to be advised of a planned audiometric test, so that they can have a 'quiet time' of ideally 16 hours beforehand. Ideally employees should be tested at the beginning of the day, having avoided loud social (e.g. night clubs or concerts, using power tools etc.) or gunfire noise exposures the day before. This reduces the likelihood of TTS. In practice this may not be possible. In these circumstances it is essential that the employee has worn adequate hearing protection AT ALL TIMES that day, perhaps over and above what is normally required. Workers using ear protection should be told to bring it along to the audiometric examination. The tester must record the fact that because of the workplace conditions TTS is a possibility and consider repeating the test at another time if abnormal.

2.3.2 History-taking is generally carried out prior to the test, normally by means of questionnaire (suggested sample in Appendix 1). This takes less than 10 minutes, and covers general noise history including occupational and hobbies, family and illness history, accidents, previous ear disease or symptoms, and the use of certain drugs known to affect hearing. The employee should sign and date the form for verification. Note that adults often do not remember or know details of childhood illnesses or drug treatments, so there are limitations to the reliability of questionnaires.

2.3.3 The otoscopic examination is usually carried out next, and findings (e.g. 'wax/clear/inflamed/dull tympanic membranes') should be noted on the questionnaire OR on the audiogram form. If there are 'scratches' in the ear canal, check about the comfort and use of earplugs (although these scratches may also be caused by zealous use of cotton buds). Ensure proper cleaning and disinfecting procedures are carried out. If active discharge is present, advise about using earmuffs rather than earplugs for noise protection. If significant amounts of wax are present, e.g. more that 50% of the tympanic membrane is obscured, it may be better to advise removal of wax by use of eardrops and or syringing before performing the test. Alternatively the test can be performed and repeated if abnormal or if it shows a drop from previous tests. Remember the presence of wax cannot improve the test result; it can only cause a poorer result than would otherwise be achieved. Similarly if a current ear infection is discovered it may be better to defer the test but the same principles apply.

2.3.4 At this point, a short inspection of hearing protection to ensure it is in good working order and that earplugs are inserted correctly, can be performed.

2.3.5 Employees should be instructed first in how to respond to audiometric signals, BEFORE being asked to remove glasses, earrings, hair bands or hearing aids. The instructions will vary slightly depending on whether the audiometer is AUTOMATIC or MANUAL.

It is sensible to have a printed card with the instructions written on it for reference, e.g.:

"You are going to hear a series of quiet beeps or tones lasting 1 or 2 seconds each, in one ear at a time, through these headphones. ANY time you think you hear a tone - no matter how faint - press the signal button (like so) to show that you have heard. Release the signal button (like so) only when the tone has stopped (so hold button down during whole tone).

There will be about 30 to 50 tones of different pitch, and the whole procedure will take about 3 to 4 minutes. If you wish to get out before the end because you feel unwell etc., just push the door or knock on the window, and we will stop. The test can be redone later"

Ask the person if they think one ear is much better than the other, then start testing the better ear. If they report no difference, start on the right ear.
AFTER instruction and having seated the person in the booth, the tester puts the headphones on the employee carefully (RIGHT ear = RED headphone, LEFT ear = BLUE headphone).

Make sure the headphone band is resting on top of the head & not slipping off the back.

Finally, make sure the booth door is fully closed and ensure an airtight seal to obtain the full soundproofing effects of the booth. Occasionally with claustrophobic individuals it is not possible to close the booth. The decision whether to proceed will depend on ambient test conditions but in any event this should be recorded in the records.

2.4 AUTOMATIC AUDIOMETRY

Most industrial settings use an automatic audiometer which, once started, will present pure tones in a computer-controlled manner, evaluate each response and decide whether a 'rising threshold' response has been obtained according to the principles of audiometry; 'rising threshold' means the smallest tone heard when the signal volume is being increased. The machine can be set to run a different set of frequencies or present a different signal type (pulsed or continuous tone are usually offered). Most machines will run in the order 1, 2, 3, 4, 6 and 8 kHz then 500 Hz, (plus 250 Hz if set), (followed by (1 kHz) repeat & so on if required) in one ear, then the same sequence in other ear. Start with the better ear if the option is available.

Some machines have a separate 'familiarisation tone sequence' with louder signals to demonstrate the type of sounds. This can be run BEFORE the threshold test if people have never had an audiogram before; it is not necessary for people doing routine repeat audiograms.

It is important that the operator of the audiometer checks that the person being tested is actually continuing to listen to the tones and is not either:

- ▲ Pressing randomly or not at all
- ▲ Making a lot of noise by moving around inside the booth or coughing etc.
- ▲ Showing obvious signs of boredom/ tiredness/ illness/ uncooperativeness etc.

If any of the above occurs, talk to the employee first either via the 'talkover microphone', or open the booth door, ensure understanding of the test and a comfortable environment in the booth (not too hot etc.). Then, if necessary, consider doing the test manually or postpone the test if the person is obviously unhappy.

As soon as the test is complete, let the person out of the booth as the soundproofed, enclosed environment is unpleasant for most.

2.5 MANUAL AUDIOMETRY

Some audiometers can be controlled by the operator throughout the test, which may lead to a quicker test time for an experienced operator. The instructions/sequence of signals is basically the same. The person operating the audiometer has more flexibility in presenting occasional 'louder' signals if people's responses seem erratic. Also, for people who do have a known hearing loss, the operator can raise the signal immediately to an appropriate level, whereas the computer controlled test will not have this advanced level of sophistication and will give gradually increasing signals; thus taking longer.

2.6 INTERPRETATION OF AUDIOGRAM

Young adults without major noise exposure or identified hearing loss in the past are the 'baseline hearing comparison point' for other workers. Normal hearing is NOT 0dB across all frequencies.
On average, men have slightly worse high frequency hearing than women (ISO 7029:2000) but this may not show in 5dB step audiometry until about the age of 30.

2.6.1 Method of Categorization:

An experienced medical specialist such as a specialist occupational physician or otolaryngologist (ENT) will **not** normally require assistance in assessing an audiogram.

The categorisation system exists simply to allow for simple triage by a non specialist of audiogram. It allows, for example, for an occupational health nurse to identify those who might need further assessment, those who might require repeat testing and those who can safely be allowed routine follow up.

It is NOT a diagnostic tool. It does not for example differentiate NIHL from hearing loss for any other reason.

It is also NOT a means for assessing disability for compensation or other purposes and should never be used for that reason.

Whist the system will identify most persons who require follow up it is important to remember that these are guidelines only and if a tester has any concerns for any reason with regard to an individual they should request further assessment or advice regardless of the classification.

It should be noted that while broadly similar principles apply as did to the previous categorisation system there are significant changes. The tables have changed in order to better identify those who would benefit from further action. In addition the numerical values have changed. It is appreciated that this may cause some initial confusion and will require some extra explanation to workers familiar with the previous systems. However the new system has the advantage that it will require less software adjustments to computerised audiometers which are now increasingly commonly used.

The Categorisation system has **4 separate** steps

STEP 1 — Categorisation of hearing level

Calculate the appropriate sum value for the hearing levels obtained at **1, 2, 3, 4 and 6 kHz** frequencies so that a single value is obtained for each ear. This sum of frequencies has been chosen as being representative of the effects of NIHL. Although this scheme recommends a sum of hearing levels at specific frequencies, it is important that audiometry is still conducted at 0.5 and 8 kHz. Table 1 provides details of the four categories. Table 2 provides the relevant warning and referral thresholds for these sums taking into account the age and gender of the individual.

Check Table 2 to see if the person **exceeds** the table value given for their age and gender.

If the sum for each ear is BELOW the Warning level, that individual is placed in **Category 1 (acceptable hearing ability)** (this approximately equates to category 5 or 0 under the old system, but as the tables differ, there is not exact equivalence).

If the sum for either ear EXCEEDS or EQUALS the listed figure for the Warning level for the relevant age and gender the individual is categorised as **Category 2 (mild hearing impairment). The individual should be advised of results** (this approximately equates to category 4 under the old system, but as the tables differ, there is not exact equivalence). Normally it is not necessary to refer all of these cases but they, of course, can be at the discretion of the responsible doctor. The Warning level corresponds with the 20th percentile i.e. hearing level normally experienced by 1 person in 5. It may indicate developing NIHL.

If the sum for either ear EXCEEDS or EQUALS the listed figure for the Referral level for the relevant age and gender the individual is categorised as **Category 3 (poor hearing). The individual should be advised of results and should be referred for review by a medical specialist in Occupational Medicine or Otolaryngology (ENT)** (this approximately equates to category 3 under the old system, but as the tables differ, there is not exact equivalence). The Referral level corresponds with the 5th percentile i.e. hearing level normally experienced by 1 person in 20. It may indicate significant NIHL.

STEP 2 — Categorisation based on rapid hearing loss

If a previous hearing test on the individual is available within the last **3 years,** it is necessary to look at the **RATE OF CHANGE**. For this we add the sum of the hearing thresholds at **3, 4, 6 kHz** only in each ear. If the difference between the sums in these frequencies is **30dB** or more this is designated as **Category 4 (rapid hearing loss). The individual should be advised of results and should be referred for review by a medical specialist in Occupational Medicine or Otolaryngology (ENT)** (this approximately equates to category 1 under the old system, but as the tables differ, there is not exact equivalence).

It is of course possible that a single audiogram can satisfy the criteria for **Category 2 or 3 AND 4**. This in effect does not matter as it will require review by a specialist in

any event. For statistical analysis the audiogram can be classified as the highest number or if preferred can have dual classification i.e. **Category 3 and 4.**

STEP 3 — Classification on unilateral hearing loss

For this we add the sum of the hearing thresholds at **1, 2, 3, 4 kHz** only for both ears. If the difference between the ears is greater than **40dB, the individual should be advised of results and should be referred for review by a medical specialist in Occupational Medicine or Otolaryngology(ENT)** (this approximately equates to category 2 under the old system, but as the tables differ, there is not exact equivalence). It should be noted that this does not attract a formal category but can be classified as **Category 5** if required for statistical analysis. This type of loss is rarely occupational but should be assessed urgently, unless old, to rule out pathology such as an acoustic neuroma.

STEP 4 — Overview of audiograms

When a number of hearing tests are performed it is advisable that a group review of results be made by a medical practitioner experienced in such an assessment to ensure no relevant patterns emerge which were not identified by assessment of individual assessments. For example it might be noted that one group such as maintenance, is showing more rapid loss than another even though no individual shows excessive loss. This however may be very relevant in preventing NIHL in the workplace.

Table 1 — Categorisation Scheme

Category	Calculation	Action
1 Acceptable hearing ability Hearing within normal limits.	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz.	None
2 Mild hearing impairment Hearing within 20th percentile, i.e. hearing level normally experienced by 1 person in 5. May indicate developing NIHL.	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz. Compare value with figure given for appropriate age band and gender in Table 2.	Warning
3 Poor hearing Hearing within 5th percentile, i.e. hearing level normally experienced by 1 person in 20. Suggests significant NIHL.	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz. Compare value with figure given for appropriate age band and gender in Table 2.	Referral
4 Rapid hearing loss Reduction in hearing level of 30dB or more, within 3 years or less. Such a change could be caused by noise exposure or disease.	Sum of hearing levels at 3, 4, and 6 kHz.	Referral

From HSE UK Controlling Noise at Work

Table 2 – Classification of Audiograms into Warning and Referral Levels				
	Male		Female	
Age	Warning	Referral	Warning	Referral
18-24	51	95	46	78
25-29	67	113	55	91
30-34	82	132	63	105
35-39	100	154	71	119
40-44	121	183	80	134
45-49	142	211	93	153
50-54	165	240	111	176
55-59	190	269	131	204
60-64	217	296	157	235
65	235	311	175	255

From HSE UK Controlling Noise at Work

3. Administration

3.1 REVIEW SCHEDULES FOR DIFFERENT CATEGORIES AND EXPOSURE LEVELS

FREQUENCY OF TESTS

First Hearing Test

This should be made available within 12 months of worker being exposed above ***lower exposure action level.*** However, where practical a baseline (PRE-EMPLOYMENT) is preferable.

FURTHER TESTS

Category 1 (Normal)

A second screen should be conducted within a year of initial screening, and thereafter at the recommended intervals (below) of not more than 5 years (3 year maximum if ***upper exposure action level*** (85dB Lex) is exceeded, or yearly if noise greater than 95 dB Lex).

However to fully utilize the categorization system above, a 3 yearly interval is recommended for all workers requiring audiograms.

Other Categories

The same minimum review schedule as above, but with discretion to shorten review times if workers are showing signs of NIHL, if they are being referred, or, for example, if a treatable or temporary condition is affecting the worker at an initial test (wax, ear infection) and an early repeat is indicated after treatment. It is usually appropriate that referral Categories (Categories 3 &4) are tested annually or perhaps more frequently if an occupational element is suspected.

Warning category (Category 2) is often tested every two years or more frequently if indicated.

3.2 KEEPING OF RECORDS OF HEARING CHECKS

Regulation 131 requires an employer to ensure that a health record of each of his or her employees who undergoes health surveillance is made and maintained and that the record or a copy is kept available to permit appropriate access at a later date, taking into account any confidentiality concerns. The registered medical practitioner (RMP) or health care professional responsible for screening must keep a copy of the hearing check records as a minimum for 15 years from the date of the last test. If the personnel involved change during that time, ideally the hearing check records and responsibility should be forwarded to a new RMP. If this causes difficulty, contact the HSA Occupational Health Unit.

3.3 ADVICE TO WORKERS

Workers can ask for the information contained in their own hearing check records to be made available, provided they give reasonable notice to the RMP. The results should

be explained by the doctor or health care professional to the employee in terms that the employee understands. The employee is normally entitled to a copy of their individual test if requested.

3.4 ADVICE TO EMPLOYERS

Employees should ideally consent to employers being informed of an individual's category prior to testing. The Medical Officer where one exists at the workplace, must always be advised of individual categorisation and results to enable an appropriate assessment of individual risk factors. Employers need enough information to establish whether specific areas of risk exist in the workplace, and whether action such as referral is required. Employers should NOT have access to medical information on the employee including that which may be included in any questionnaire without the expressed permission of the employee. The RMP or health care professional in charge of the record is responsible for ensuring confidentiality is respected.

3.5 REFERENCES

List of Reference Standards Documents:

ISO 6189:1983 Acoustics. Pure tone air conduction threshold audiometry for hearing conservation purposes.

ISO 1999: 1990(E). Acoustics. Determination of occupational noise exposure and estimation of noise-induced hearing impairment.

ISO 8253-1:1989 Acoustics. Audiometric Test methods - Part 1: Basic pure tone air and bone conduction threshold audiometry.

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Appendix I: Sample Audiometric Questionnaire

Name: _____ **Date of Birth:**_____

Address: _____

Family Doctor's Name and Address: _____

Company Number: _____ **Job Description:** _____ **Years with Co.:** ___

The following questions are completed before testing to be used only in relation to your hearing test – let the tester know if you are unsure about anything.

1. Have you ever had a hearing test before?
   If you have, please state where and approximately when?
2. Have you worked in previous noisy jobs?
   If yes, where and when?
3. Name any noisy areas you work in, in your current job:
4. Do you think you might have a hearing problem?
   If yes, describe any times you have difficulty:
5. Do any family members have hearing problems/use hearing aids?
   Who?
6. Do you have any troubling noises in your head or ears?
   If yes, where and when?
7. Have you ever had ear trouble such as wax, ear infections, blockages in the ear?
   If yes, describe:
8. Name main pastimes/ any part-time work that you do:
9. Do you regularly use a motorbike, attend motor-racing or use guns?
10. Do you smoke?
11. Have you had a cold in the last fortnight?
12. Have you been in loud noise in the last 16 hours, e.g.
    (At disco/music pub/in band/working in noise or with power tools)?
13. Tick any of these illnesses etc. that you have had:
    Head/Neck Injury, ❑ Bacterial Meningitis, ❑ Mumps/Measles, ❑
    Scarlet/Rheumatic Fever ❑, Epilepsy ❑, TB Treated ❑, Kidney Infection ❑,
    Ear/ Nose /Throat /Specialist Appointment ❑
14. Are ear protectors always available at work?
15. Do you wear ear protection in noise? Always ❑ Sometimes ❑ Rarely ❑
    Type used: Ear Plugs ❑ Ear Caps ❑ Ear Muffs/Headphones ❑

Declaration: The information I have given is complete and correct; withholding information may interfere with the hearing assessment & make it invalid. I can ask for an explanation of my results after the test. I understand that my employer will see the classification of my audiogram but is not entitled to any medical information given here without my permission.

Signed: _____

Witness Signature: _____

Date: _____

Appendix II: Worked Examples of Categorisation of Sample Audiograms

WORKED EXAMPLE 1 – 34 year old male. Baseline.

Baseline							
	500 Hz	1k Hz	2k Hz	3k Hz	4k Hz	6k Hz	8k Hz
Right	0	15	25	40	55	45	30
Left	5	10	30	40	60	50	35

STEP 1

Add 1, 2, 3, 4 and 6 kHz for each ear.
This gives us :
Sum Right: 180
Sum Left: 190

Compare to Table 2 for age and gender

Age	Warning	Referral
30-34	82	132

The figures exceed the Referral level so this audiogram is categorised as Category 3 and should be referred for specialist opinion.

STEP 2 – Not applicable for baseline.

STEP 3 – We add the results for the frequencies 1, 2, 3, 4 kHz only for both ears.

Right	135
Left	140

In this case the difference is 5 dB, which is less than 40, so there is no need to classify as unilateral hearing loss.

STEP 4 – This overview of results is not applicable for a single test result.

WORKED EXAMPLE 2 – 53 year old male. 2nd Test.

Baseline 2004							
	500 Hz	1k Hz	2k Hz	3k Hz	4k Hz	6k Hz	8k Hz
Right	10	15	20	25	45	45	50
Left	5	10	25	25	40	40	35

Test 2006							
	500 Hz	1k Hz	2k Hz	3k Hz	4k Hz	6k Hz	8k Hz
Right	10	15	25	35	45	45	50
Left	5	20	40	60	65	70	50

Categorisation of 2006 audiogram

STEP 1 – Add 1, 2, 3, 4 and 6 kHz for each ear.

This gives us :

Right	165
Left	255

Compare to Table 2 for age and gender

Age	Warning	Referral
50-54	165	240

The figures for the right ear equals the Warning level and the left ear exceeds the Referral level so this audiogram is categorised as Category 3 and should be referred for specialist opinion.

STEP 2 – There is less than three years between tests so this test is applicable.

For this we add the sum of the hearing thresholds at 3, 4, 6 kHz only in each ear.

This gives:

	2004	2006
Right	115	125
Left	105	195

The difference in the left ear is 80 dB, which is greater than 30, so this is also classified as Category 4 or rapid hearing loss and requires referral to a specialist even if the totals do no exceed the referral levels otherwise.

STEP 3 – We add the results for the frequencies 1, 2, 3, 4 kHz only for both ears.

Right	120
Left	185

In this case the difference is 65, which is greater than 40, so it is necessary to classify as unilateral hearing loss. This requires referral to a specialist even if the totals do no exceed the referral levels otherwise.

STEP 4 – This overview of results is not applicable for a single test result.

In summary therefore this audiogram is classified as Category 3 on absolute hearing levels AND Category 4 on rapid rate of change AND unilateral hearing loss (Category 5 if preferred).

Guidelines on Hearing Checks and Audiometry under the Safety, Health and Welfare at Work (General Application) Regulations 2007, Control of Noise at Work

Working to create a National Culture of Excellence in Workplace Safety, Health and Welfare for Ireland

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