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Noise-induced hearing loss: Prevalence, degree and impairment criteria in South African gold miners

by

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Abstract

Despite the preventability of noise-induced hearing loss (NIHL) a high prevalence is still reported in South African mines. The study aimed to describe the hearing of gold miners pertaining to the prevalence and degree of NIHL and effectiveness of current RSA impairment criteria to identify NIHL.

The audiological data, collected between 2001 and 2008, of 57 714 mine workers were investigated in this retrospective cohort study. Data was accessed through the mine's electronic database and exported to Microsoft Excel 2007 worksheets. Participants were categorised in terms of noise exposure (level and working years), age, race and gender. Noise exposure levels were described in terms of a specific occupation and categorized into four groups based on dosimeter data received from the mine's noise hygienist, namely: 1) Below surface (underground) noise exposure, ≥85 dB A, classified according to the South African regulations on the daily permissible dose of noise exposure[8], named Noise Group 1; 2) Surface noise exposure, ≥85 dB A, named Noise Group 2; 3) No known occupational noise exposure, named control group; and 4) Uncertain levels of noise exposure, e.g. students and trainees, named Noise Group 4. The control group was matched with participants of noise group 1 and 2 based on gender, race and age at the most recent audiogram test. Descriptive and inferential statistics were employed. Measures of central tendency and variability were used with analysis of covariance (ANCOVA) and pairwise comparisons according to Fisher's Least Squares Differences Approach (F test).

Results indicated that noise exposed groups had significantly higher prevalence of high and low frequency hearing loss than the control group. High-frequency hearing loss was also present in the control group. The greatest differences in prevalence of hearing loss were observed at 3, 4 kHz and age group 36 to 45 years. Thresholds at 8 kHz were worse than expected and decline slowed down with age. High-frequency thresholds showed a non-linear growth pattern with age with a greater decline at 2 kHz with age in the noise-exposed population compared to the control group. Hearing deteriorated more across age groups with more noise-exposed years, and this deterioration was most visible after 10 to 15 working years and at 3 kHz. Females had better hearing than males across the frequency spectrum. Black males

had significantly better high-frequency hearing than white males but significantly worse low-frequency hearing than white male counterparts. PLH values showed poor correlation (through statistical analyses) with other well-accepted hearing impairment criteria.

To date this was the largest study conducted on the hearing of gold miners and the sample included a very large number of black males exposed to occupational noise (N=17 933). Values supplied in distribution table format are therefore unique and contribute greatly to the knowledge base.

Key terms:

Noise-induced hearing loss

Gold mines

Occupational noise

Percentage loss of hearing

Race

Gender

Age related hearing loss

Noise exposure

Prevalence

Degree of hearing loss

Notch

Table of contents

ACKNOWLEDGEMENTS ..... **II**

ABSTRACT ..... **III**

KEY TERMS: ..... **IV**

TABLE OF CONTENTS ..... **V**

TABLE OF FIGURES AND TABLES ..... **IX**

LIST OF ACRONYMS ..... **XVI**

CHAPTER ONE INTRODUCTION AND RATIONAL **1**

1.1. Introduction and study rational *1*

CHAPTER TWO LITERATURE REVIEW **10**

2.1. Historical overview of noise-induced hearing loss (NIHL) *11*

2.2. Worldwide prevalence of NIHL *14*

2.3. Prevalence of NIHL in South African mining *16*

2.4. NIHL Mechanism of damage *18*

2.5. NIHL and the audiogram *27*

2.5.1. The notched audiogram 27

2.6. Individual susceptibility and confounding factors in NIHL *32*

2.6.1. Age 33

2.6.1.1. Age, smoking and NIHL 34

2.6.1.2. Age, genes and NIHL 35

2.6.1.3. Age correction and the NIHL audiogram 35

2.6.2. Gender 37

2.6.3. Race 39

2.7. Summary *40*

CHAPTER THREE LITERATURE REVIEW **41**

3.1. Defining noise hazard *42*

3.1.1. Historical overview of noise definitions and measurements 43

3.1.2. Noise measurement scales 44

3.2. Damage risk criteria: Levels and duration of noise exposure *46*

3.2.1. Level of noise exposure – where does the risk to human hearing begin? 46

3.2.2. Duration of noise exposure - the time-intensity relationship 51

3.3. Exposure limit *53*

3.4. Compensation for hearing impairment *55*
3.4.1. Formulae and calculation of hearing impairment 57
3.4.2. Contribution of age when calculating hearing impairment 62
3.5. Summary and conclusion *63*

CHAPTER FOUR METHODOLOGY 65

4.1. Introduction *66*
4.2. Problem statement *67*
4.3. Aims *68*
4.4. Hypotheses *68*
4.5. Research Design *70*
4.6. Ethical considerations *71*
4.7. Sample *72*
4.7.1. Population 72
4.7.2. Criteria for selection of participants 74
4.7.2.1. Noise exposure 75
4.7.2.2. Age, race and gender 76
4.7.3. Description of research participants 76
4.8. Data Collection *85*
4.8.1. Collection protocols and procedures 85
4.8.2. Personnel requirements for data collection 88
4.8.3. Requirements of the equipment and test procedures for data collection 88
4.9. Data analysis procedure *89*
4.9.1. Data organisation 89
4.9.2. Data cleaning 91
4.9.3. Statistical analyses 93
4.10. Validity and reliability *95*
4.11. Chapter summary *97*

CHAPTER FIVE RESULTS 98

5.1. Introduction *99*
5.2. Sub aim one: Prevalence and degree of hearing loss *101*
5.2.1. Prevalence and degree of hearing loss by pure tone averages 101
5.2.2. Prevalence and degree of hearing loss across individual frequencies 111
5.3. Sub aim two: Prevalence and degree of hearing loss as a function of age, race and gender *114*

5.3.1. Prevalence and degree of hearing loss as a function of age by pure tone averages 114
5.3.2. Prevalence and degree of hearing loss as a function of age across individual frequencies 117
5.3.3. Prevalence and degree of hearing loss as a function of race and gender across individual frequencies 120
5.3.4. Prevalence and degree of hearing loss as a function of race and gender by pure tone averages 124
5.4. Sub aim three: Prevalence and degree of hearing loss as a function of occupation / noise-exposure level 127
5.4.1. Prevalence and degree of hearing loss as a function of noise exposure time by age group and across individual frequencies 127
5.4.2. Prevalence and degree of hearing loss as a function of noise- exposure level for homogenous exposure groups across individual frequencies 132
5.5. Sub aim four: The combined effect of various biographical, environmental and work-related variables on hearing status 138
5.6. Sub aim five: To evaluate the effectiveness of the current impairment criteria to identify NIHL and compare it to other existing criteria 154
5.7. Chapter summary 157

CHAPTER SIX DISCUSSION 158

6.1. Introduction 159
6.2. Prevalence of NIHL in the cohort of gold miners 159
6.2.1. Considerations when describing prevalence of NIHL 159
6.2.2. Discussion of the prevalence of NIHL in the study population 163
6.3. Comparison of hearing thresholds in the gold miner cohorts 177
6.4. Effect of age on hearing in different noise exposure groups 181
6.4.1. Hearing loss increase with age and the effect of noise exposure time 182
6.4.2. Differential deterioration of hearing across frequency with increasing age ... 183
6.5. Effect of gender and race on hearing in different noise exposure groups 186
6.6. Effectiveness of PLH to identify NIHL 190
6.7. Summary 192

CHAPTER SEVEN CONCLUSION 193

7.1. Introduction 194
7.2. Overview of the literature study 194
7.3. Research objectives: Conclusion, implications and recommendations 197

7.3.1. Sub aim one: Prevalence and degree of hearing loss 199
7.3.1.1. Sub aim one: Hypotheses revisited 199
7.3.2. Sub aim one: Conclusions, implications and recommendations 199
7.3.3. *Sub aim two:* Prevalence and degree of hearing loss as a function of age, race and gender 201
7.3.3.1. Sub aim two: Hypotheses revisited 201
7.3.4. Sub aim three: Prevalence and degree of hearing loss as a function of occupation / noise-exposure level 202
7.3.4.1. Sub aim three: Hypothese revisited 202
7.3.5. Sub aim four: Combined effect of various biographical, environmental and work-related variables on hearing status 203
7.3.5.1. Sub aim four: Hypotheses revisited 203
7.3.6. Sub aim two to four: Conclusions, implications and *recommendations* 204
7.3.7. Sub aim five: The effectiveness of the current impairment criteria to identify NIHL and compare it to other existing criteria 206
7.3.7.1. Sub aim five: Hypotheses revisited 206
7.3.7.2. Sub aim five: Conclusions, implications and *recommendations* 207
7.4. Critical evaluation of the study 209
7.4.1. Limitation of the study 209
7.4.2. Contributions of the study 211
7.5. Suggestions for further research 213
7.6. Final comments 213

CHAPTER EIGHT REFERENCES 214

APPENDIXES 232

Table of figures and tables

Figure 1-1 NIHL number and rate per commodity (Randera, 2007)..... 5
Figure 1-2 Audiogram for a typical NIHL (values based on an illustration by Dobie (2001).... 7
Figure 2-1 Underreporting of occupational diseases. Source: Scott, Grayson, & Metz (2004) 16
Figure 2-2 (A) The ear and cochlea (B) Regions of the cochlea showing the sound conduction path. Source: Kurmis & Apps (2007)..... 20
Figure 2-3 Cross section of the basilar membrane showing sensory hair cells of the cochlea. Saunders, Dear, & Schneider (1985) 21
Figure 2-4: Scanning electron micrograph showing the normal organisation of the organ of Corti. View is of the apical membrane of the single row of IHCs (top) and 3 rows of OHC (bottom). Notice the orderly arrangement of stereocilia (Picture retrieved from http://www.d.umn.edu/~jfitzake/Lectures/DMED/InnerEar/IEPathology/StereociliaDamage.html)..... 24
Figure 2-5: Disruption of IHC stereocilia and loss of OHC in the basal turn of the cochlea following noise exposure (90 dB A noise for 8 hours) 6 months earlier. This damage produced a profound hearing loss (Picture retrieved from http://www.d.umn.edu/~jfitzake/Lectures/DMED/InnerEar/IEPathology/StereociliaDamage.html)..... 24
Figure 2-6: A line drawing of the hair cells of the organ of Corti with a cross section view. Source: Saunders, Dear & Schneider (1985) 24
Figure 2-7: Different levels of damage to the organ of Corti. Source: Saunders, Dear & Schneider (1985) 25
Figure 2-8: Audiogram demonstrating the typical notch of NIHL. Source: Rabinowitz et al. (2006) 28
Figure 2-9: Median (50th percentile) and extreme (10th and 90th percentiles) NIPTS after 30 years of workplace exposure to 95 dB A. Source: ISO 1990:1999 29
Figure 3-1 Aspects considered in damage risk criteria for occupational noise exposure 46
Figure 3-2 Mathematical relationship demonstrating the equal energy rule..... 51
Figure 3-3 Claims submitted to the Compensation Fund during 2001-2006 (Source: RSA Compensation Fund, 2006)..... 56
Figure 3-4 Instruction 171, PLH calculation table for 0,5 kHz (Source: COIDA, 2001, complete document included as Appendix C) 60

Figure 3-5 Audiogram (left and right ears identical) with 0 dB HL, high frequency hearing loss, and low frequency hearing loss and associated PLH values 61
Figure 4-1 Research Design 66
Figure 4-2 Number of participants categorised into the different Noise Groups (Ntotal = NNoise Group 1 + NNoise Group 2 + NNo Noise Group + NNoise Group 3 = 57713)..... 77
*Figure 4-3 Number of participants in each age category for the Driller and Administration groups (*NAdmin = 2211; NDriller = 4399*)*..... 82
Figure 5-1 Sub aims of this study constituting the main aim 99
Figure 5-2 Median values for the HFA346 and the LFA512 for Noise Group 1 and No Noise Group (Noise Group 1: Underground occupational noise ≥85 dB A TWA (n= 33961); No Noise Group: No known occupational noise (n=6194)) 108
Figure 5-3 95th Percentile values for the HFA346 and the LFA512 for Noise Group 1 and No Noise Group (Noise Group 1: Underground occupational noise ≥85 dB A TWA n= 33961; No Noise Group: No known occupational noise n=6194) 109
Figure 5-4 Median and 95th Percentile values for the pure tone average (PTA512) and high frequency average (HFA346) of participants in Noise Group 1 and No Noise Group (Noise Group 1: Underground occupational noise ≥85 dB A TWA , n= 33961; No Noise Group: Occupational noise <85 dB A, n=6194) 110
Figure 5-5 Left ear, medians and 95th percentile threshold values (dB HL) per frequency (Noise Group 1: Underground occupational noise ≥85 dB A (TWA), n= 33961; No Noise Group: No known occupational noise, n=6194) 112
Figure 5-6 Right ear, medians and 95 percentile threshold values (dB HL) per frequency. Noise Group 1: Underground occupational noise ≥85 dB A TWA (n= 33961) No Noise Group: No known occupational noise (n=6194) 113
Figure 5-7 Percentage of participants in Noise Group 1 and the No Noise Group per age group across the hearing-sensitivity category for the Low Frequency Averages (LFA512) 115
Figure 5-8 Percentage of participants in Noise Group 1 and the No Noise Group per age group per hearing sensitivity category for the High Frequency Averages (HFA512)..... 116
Figure 5-9 Median thresholds (in dB HL) per frequency for each age category for Noise Group 1 (N=33961) 118
Figure 5-10 Median values for thresholds in dB HL per frequency for participants in Noise Group 1 categorised by race and gender (Black Male, n=35866; White Male, n=5374; Black Female, n=1698; White Female, n=434) 121
Figure 5-11 95th Percentile values for thresholds in dB HL per frequency for participants in Noise Group 1 categorised by race and gender (Black Male, n=17933; White Male, n=; Black 2687Female, n=849; White Female, n=217) 122

Figure 5-12 Median and 95th percentile values of the high frequency average for thresholds at 3, 4, and 6 kHz, (HFA346) compared for the different race and gender groups within the different Noise Groups *125*
Figure 5-13 Median and 95th percentile values of the low frequency average for thresholds at 0,5, 1, 2 kHz, (LFA512) compared for the different race and gender groups within the different Noise Groups frequency (Noise Group 1: Underground occupational noise ≥85 dB A TWA (n= 33961); No Noise Group: No known occupational noise (n=6194)) *126*
Figure 5-14 Median thresholds per frequency for the age group 16 to 30 years categorised by their working years (Noise Group 1, occupational noise 85 dB TWA) *128*
Figure 5-15 Median thresholds per frequency for the age group 31 to 40 years categorised by their working years (Noise Group 1, occupational noise 85 dB TWA) *129*
Figure 5-16 Median thresholds per frequency for the age group 41 to 50 years categorised by their working years (Noise Group 1, occupational noise 85 dB TWA) *130*
Figure 5-17 Median thresholds per frequency for the age group 51 to 60 years categorised by their working years (Noise Group 1, occupational noise 85 dB TWA) *131*
Figure 5-18 Median thresholds per frequency for the age group 61 to 65 years categorised by their working years (Noise Group 1, occupational noise 85 dB TWA) *132*
Figure 5-19 Number of participants for the administration group per race and gender and age category *133*
Figure 5-20 Number of participants for the driller group per race and gender group *134*
Figure 5-21 Median and 95 th Percentile values for thresholds (in dB HL) across the frequency range for homogenous exposure groups (HEGs); Drillers and Admininstration (Admin) *135*
Figure 5-22 Median values for thresholds (in dB HL) across the frequency range for black, male participants in the Driller and Administration (admin) groups, for ages 31 to 40 years, 41 to 50 years, and 51 to 60 years *136*
Figure 5-23 95th Percentile values for thresholds (in dB HL) across the frequency range for Black, Male participants in the Driller and Administration (admin) group, for ages 31 to 40 years, 41 to 50 years, and 51 to 60 years *137*
Figure 5-24 Mean values for binaural hearing impairment calculated using the AMA formula for participants in the different PLH groups. PLH groups based on the PLH values in percentage calculated for all participants (N=57691) *155*
Figure 5-25 Comparison of numbers of participants (total N=57713) who would have been compensated based on the hearing impairment comparing the PLH and AMA formulae of hearing impairment *156*
Figure 6-1 Framework for discussion of study findings related to study aims *159*

Figure 6-2 Different noise groups, and sub groups, the prevalence of NIHL compared to the control group and data used in analyses *164*
Figure 6-3 Estimated excess risk for hearing impairment at 41dB HL or greater, by age and duration of the exposure (Source: Nelson, Nelson, Concha-Barrientos, & Fingerhut, 2005) *167*
Figure 6-4 Prevalence data of hearing loss greater than 40 dB HL for the general population in Great Britain (Source (Nelson, Nelson, Concha-Barrientos, & Fingerhut, 2005; Davis A. C., 1989) *168*
Figure 6-5 Comparison between Girard et al. (2009) and the current study's negative growth in prevalence of the normal hearing category with increase in age (shown as a difference in the percentage of participants with normal hearing between the subsequent age groups) *173*
Figure 7-1 Main aspects reviewed in the literature study in Chapters 2 and 3 ..... *195*
Figure 7-2 Summary of conclusions based on the results and discussion (chapter 5 and 6) of this study. *198*
Figure 7-3 Two-step audiological process recommended for South African mines to identify NIHL and allocated compensation. *209*

Table 1-1A comparison of the calculated "percentage of hearing impairment" using different criteria for the audiogram shown in figure 2 ..... *8*
Table 2-1 Compensation paid for NIHL in South African Mines *18*
Table 2-2 Noise-induced hearing loss: Area of the cochlea where damage occurs, description of the mechanism of damage and illustrations *23*
Table 2-3: Notch criteria from Coles et al. (2000) and Niskar et al. (2001). Source: Rabinowitz et al. (2006) *30*
Table 3-1 Comparison of models for estimating the excess risk of material hearing impairment at age 60 after a 40-year working lifetime exposure to occupational noise (8-hour TWA), by definition of material hearing impairment *49*
Table 3-2 Some features of legislation in various countries (1997). Source: Johnson, Papadopoulos, Watka, & Takala, 2006 ..... *55*
Table 3-3 Summary of US states federal compensation agencies with regard to the formulas used to calculate hearing impairment caused by NIHL (Source: Stander & Sataloff, 2006) . *58*
Table 4-1 Number of participants for each occupation (labelled by the mine) constituting each Noise Group. *78*
Table 4-2 Number of participants categorised into different age categories per Noise Group (Total N=57713) *81*

Table 4-3 Number of participants categorised into different age categories and race groups (white and black) per Noise Group 83
Table 4-4 Number of participants in the Driller and Administration Groups in the different race groups (black and white) 84
Table 4-5 Number of participants in each Noise Group, categorised by race and gender ... 84
Table 4-6 Definition and requirements for audiometry as required by the gold mines under investigation, its application, purpose and procedural requirements (Franz & Phillips, 2001) 86
Table 4-7 Hearing threshold categories based on the degree of impairment proposed by Yantis (1994) and used by Picard (2008) and Girard (2009) 90
Table 4-8 Summary of data cleaning done, reasoning and amount of audiogram data disregarded (Data cleaning reduced dataset from 223 873 records to 171 441 records)..... 92
Table 5-1 Hearing threshold categories based on the degree of impairment proposed by Yantis (1994) and used by Picard (2008) and Girard (2009) 101
Table 5-2 Distribution of workers according to hearing sensitivity (bilateral HFA346 and LFA312) and noise-exposure levels ($N0-15$ + $N15-30$ +$N31-40$ +$N41-50$ +$N51$ +=$N1$/ $N3$/ $N2$) 102
Table 5-3 Distribution of workers according to hearing sensitivity (bilateral HFA346), noise-exposure levels and ISO 1990:1999 age categories 103
Table 5-4 The 95% confidence intervals (CI) for the difference of the population proportions between Noise Group 1 and No Noise Group (Table 5.4 a) and between Noise Group 2 and No Noise Group (Table 5.4 b) according to hearing sensitivity, for high frequency averages (HFA346) and low frequency averages (LFA512) 105
Table 5-5 Breakdown of numbers (n) of participants (with percentage of sample indicated) categorised in the different Noise Groups and different age categories used for calculations of proportion of the different hearing sensitivity categories (shown in figures 5.7 and 5.8) 114
Table 5-6 Median threshold values (in dB HL) per frequency for the No Noise Group categorised by age groups, Noise Group 1 values show where a difference exists between the values of the two groups (Noise Group 1: Underground occupational noise ≥ 85 dB A TWA , No Noise Group: No known occupational noise) 119
Table 5-7 Median and 95th percentile values for thresholds (in dB HL) across frequency for the No Noise Group according to gender and race. Noise Group 1 values were included when a difference existed between the two groups (Noise Group 1: Underground occupational noise ≥85 dB A TWA; the No Noise Group: No known occupational noise). 123
Table 5-8 Number of participants in each age group, categorised according to their working years (Noise Group 1: Underground occupational noise ≥85 dB A TWA)..... 128

Table 5-9 Number of participants of the study per age group (as defined by ISO 1990:1999) 139
Table 5-10 Hearing-threshold level (in dB HL) for the No Noise Group (no known occupational noise exposure) for men and female of different ages 140
Table 5-11 Hearing-threshold level (in dB HL) for Noise Group 1 (underground occupational noise exposure ≥ 85 dB A) for men and female of different ages 141
Table 5-12Hearing-threshold level (in dB HL) for Administration Group (no known occupational noise exposure) for men and female of different ages 142
Table 5-13 Hearing-threshold level (in dB HL) for drillers (underground occupational noise exposure ≥ 90 dB (A)) for men and female of different ages 143
Table 5-14 Hearing thresholds (in dB HL) for men in the No Noise group (no known occupational noise exposure) for different race and age groups 144
Table 5-15 Hearing thresholds (in dB HL) for men in Noise Group 1 (underground noise exposure of ≥ 85 dB A) for different race and age groups 145
Table 5-16 Median threshold values across frequencies for male participants of the No Noise Group and Noise Group 1 categorised by age and compared to ISO 1990:1999 Annex B, as well as Hoffman, Dobie, Ko, Themann, & Murphy (2010)'s proposed new Annex B 146
Table 5-17 Median threshold values across frequencies for female participants of the No Noise Group and Noise Group 1 categorised by age and compared to ISO 1990:1999 Annex B, as well as Hoffman, Dobie, Ko, Themann, & Murphy (2010)'s proposed new Annex B. 147
Table 5-18 Median threshold values across frequencies for male participants of the administration group (admin) and driller group categorised by age and compared to ISO 1990:1999 Annex B, as well as Hoffman, Dobie, Ko, Themann, & Murphy (2010)'s proposed new Annex B 148
Table 5-19 Median threshold values across frequencies for male participants of the administration group (admin) and driller group categorised by age and compared to ISO 1990:1999 Annex B, as well as Hoffman, Dobie, Ko, Themann, & Murphy (2010)'s proposed new Annex B 149
Table 5-20 Median values for binaural average thresholds across the frequency range for white male participants of Noise Group 1 and the No Noise Group, compared to ANSI S3.44 (1996) Annex C 150
Table 5-21 Median values for binaural average thresholds across the frequency range for black male participants of Noise Group 1 and the No Noise Group categorised by age compared to ANSI S3.44 (1996) Annex C 151
Table 5-22 Median values for binaural average thresholds across the frequency range for black male participants of the driller and administration groups (admin) categorised by age compared to ANSI S3.44 (1996) Annex C 152

Table 5-23 Median values for binaural average thresholds across the frequency range for white male participants of the administration (admin) and driller groups categorised by age compared to ANSI S3.44 (1996) Annex C..... 153
Table 6-1 Prevalence data from the current study compared to data from the Girard et al. (2009) study, categorised into ISO (1990) age categories and Yantis (1994) hearing loss categories, HFA346 used to define hearing loss. 171
Table 6-2 Noise Group 1: Number and percentage of participants in each age group (ISO 1990) for each hearing loss category (Yantis, 1994), combined percentages for hearing loss greater than 30 dB HL and percentage values of Hessel & Sluis-Cremer (1987) participants with PTA512 values greater than 25 dB HL..... 175

List of Acronyms

AMA	American Medical Association
ANSI	American National Standards
ARHL	Age related hearing loss
ASHA	American Speech and Hearing Association
COIDA	Compensation for Occupational Injuries and Diseases Act, No. 130 of 1993. South Africa
dB A	Decibel A-weighted
dB HL	Decibel hearing level
dB SPL	Decibel sound pressure level
DPOAE	Distortion Product Otoacoustic Emmission
HCP	Hearing conservation programme
HEG	Homogenous exposure group
ISO	International Organization for Standardization
kHz	Kilohertz
MHSC	Mine Health and Safety Council
NIHL	Noise-induced hearing loss
NIOSH	US National Institute for Occupational Safety and Health
OAE	Otoacoustic Emmission
OEL	Occupational exposure level
OSHA	The United States Occupational Safety and Health Administration
PLH	Percentage loss of hearing
PTA346	Pure tone average of 3, 4 and 6 kHz
PTA512	Pure tone average of 0.5, 1 and 2 kHz
RSA	Republic of South Africa
SANS	South African National Standards
SANS 10083: 2007	SANS: The measurement and assessment of occupational noise for hearing conservation purposes
TWA	Time weighted average
WHO	World Health Organization