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**NOISE-INDUCED HEARING LOSS:
A SOUTH AFRICAN CASE STUDY**

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Introduction (1)

- **NIHL – second most common form of hearing loss after age-related (Boyd, 2005)**
- **Can occur when exposed to 85 db or more over 8-hour period**
- **In addition to hearing loss exposure can result in stress, impaired communication, a decline in productivity, increased risk of accidents, compromised quality of life, social isolation, increased medical aid claims and health compensation for occupational deafness (Boyd, 2005)**
- **Exposure to noise is a reality for most construction workers (Sweeney, Fosbroke, Goldenhar, Jackson, Linch, Lushniak, Merry, Schneider, and Stephenson, 2000)**

Introduction (2)

- **Highest percentage of overexposed workers occurs in highway and street construction, carpentry, and concrete work (Suter, 2002)**
- **Canadian study determined average daily noise exposures of construction workers on roads / bridges projects was 93 dB, and the range 84-100 dB (Sinclair and Hafliidson in Suter, 2002)**

NIHL (1)

- **NIHL:**
 - **One-time exposure to a loud sound (impulse) e.g. explosion**
 - **Repeated exposure to sounds at various loudness levels over an extended period of time e.g. noise produced in an industrial or construction environment**
- **Impulse sound can result in immediate hearing loss that may be permanent:**
 - **May be accompanied by tinnitus – a ringing, buzzing, or roaring in the ears or head, which may subside over time**
 - **Hearing loss and tinnitus may be experienced in one or both ears and tinnitus may continue constantly or occasionally throughout a lifetime**

NIHL (2)

- Exposure to impulse sound and continuous noise may cause only a temporary hearing loss. If the hearing recovers, the temporary hearing loss is called a temporary threshold shift, which largely disappears 16 to 48 hours after exposure to loud noise
- Damage first occurs, it usually affects the part of the ear corresponding to the mid-frequency range of 3 – 5 kHz, which corresponds to the region where our consonant sounds are heard. A person with this form of hearing loss may experience problems and difficulty in understanding speech as the speech sounds may be muffled
- LaBenz, Cohen, and Pearson (Suter, 2002) measured the hearing of 66 operators of earth-moving vehicles and found considerably more hearing loss than in a population not exposed to noise for all age groups

Review of the literature – Importance of H&S

Plant	Sound pressure (dB)	
	Mean	Range
Heavy duty bulldozer	99	91-107
Vibrating road roller	97	91-104
Light-duty bulldozer	96	93-101
Asphalt road roller	95	85-103
Wheeled loader	94	87-100
Asphalt spreader	91	87-97
Light-duty grader	89	88-91
Labourers	90	78-107

Table 1: Average daily noise exposure levels of Canadian heavy equipment operators and labourers (Legris and Poulin in Suter, 2002)

Noise Assessment

- **According to the Health and Safety Executive (HSE) (2004) there are five steps to a noise assessment:**
 - determine whether there is likely to be a noise hazard
 - identify all workers likely to be exposed to the hazard
 - evaluate the risks arising from the hazard – establish the noise exposures to enable a decision regarding further appropriate action
 - record the findings
 - review the assessment

- **Regulation 6, South African NIHL Regulations requires employers:**
 - to conduct an assessment within six months of the commencement of the regulations, and then
 - at intervals not exceeding two years, to determine if any person is exposed to noise which is at or above the noise-rating limit

Noise Monitoring

- **Regulation 7, South African NIHL Regulations requires employers to monitor noise if an assessment indicates that persons are exposed to noise at or above the noise-rating limit**

Preventing NIHL

- **Regulation 10, South African NIHL Regulations requires that the exposure of a person is either prevented or, where this is not reasonably practicable, adequately controlled by implementing noise control measures in the following order of priority:**
 - **engineering control measures to eliminate or reduce noise at its source or, the modification of the routes by which noise reaches workplaces**
 - **administrative control measures to limit the number of persons exposed and the duration of exposure**
 - **the use of hearing protective equipment if engineering and administrative measures fail to reduce the exposure below the noise-rating limit**

Noise Zone

- **Regulation 9, South African NIHL Regulations requires the following:**
 - **the zoning of a workplace or part thereof as a noise zone, where the exposure to noise is at or above the noise-rating limit**
 - **the demarcation of the noise zone and the identification thereof with the concomitant signage, and also signage indicating that hearing protective equipment**
 - **that no person enters or remains in a noise zone unless he or she wears the required hearing protective equipment**
 - **the reason why noise exposure is at or above the noise-rating limit is identified, and that action is taken, as soon as is reasonably practicable, to lower the noise level below the noise-rating limit by means other than the use of hearing protective equipment**

Case Study - Objectives

- **The purpose of the noise survey relative to the case study was to:**
 - **assess the risks posed to workers through exposure to occupational noise**
 - **if necessary, determine and demarcate noise zones in compliance with NIHL Regulation 9, and**
 - **if necessary, make recommendations to either:**
 - **remove the risk**
 - **mitigate the risk, or**
 - **protect the workers from excessive exposures in compliance with the requirements of the Regulations**

Case study - Instrumentation and Measurement

- **Noise was measured in compliance with South African National Standard (SANS) 10083 of 2004 with a sound pressure meter acoustically calibrated prior to and at the end of measurements with an external calibrator**
- **Where possible, measurements were taken at the operator position, and then in the general work area where the generation of noise could affect workers in the area of the operating machinery**

Case Study – Measurements

Plant	Sound pressure (dB)	
	Ave	Max
Cat Grader (grading outside cab)	90.1	96.2
Roller	98.7	102.8
2 Ton vibrating roller	95.8	99.2
Front end loader (operator position)	86.1	89.8
Digger loader TR 881	85.6	99.1
Cat 30 Ton Excavator	99.7	106.9
Outside Bel Dump truck	86.5	94.8

Table 2: Noise survey results.

Case Study – Conclusions

- **The sources of sound pressure are the operations of very heavy roadwork plant and machinery**
- **The nature of the work was such that it was impossible to eliminate the sound pressure by engineering means, isolation, or enclosure**

Case Study – Recommendations (1)

- **Noise zones be clearly indicated to all persons as it is not possible to demarcate noise zones**
- **The area within 15 metres of the identified working equipment be designated as a noise zone**
- **Symbolic signs be placed prominently on the mobile equipment to indicate that the machine produces sound pressures greater than 84.9 dB (A)**
- **No person be permitted entry to a noise zone without suitable and adequate hearing protection**
- **Hearing protectors be issued to all workers in noise zones**

Case Study – Recommendations (2)

- **The wearing of hearing protection within noise zones be strictly enforced by management**
- **A comprehensive hearing conservation campaign to make employees aware of the effects of noise be instituted, including the relevant education and training**
- **All noise zone workers be immediately subjected to a audiometric screening campaign if not already been done**

Conclusions

- **The review of the literature and the case study noise measurements reinforce the contention that controlling noise in construction constitutes a challenge**
- **Generally a range of interventions are required to reduce noise in road construction: noise assessment; noise monitoring; designation of noise zones; posting of signage; wearing of hearing protection; audiometric screening; supervision, and administration**

Recommendations

- **The findings of survey of the literature, the case study, and the conclusions thereof, amplify the need for contractors to comply with the requirements of legislation**
- **Raise the level of awareness with respect to the noise generated by construction plant and machinery**
- **Tertiary built environment education, particularly civil engineering and construction management programmes, should address noise control particularly relative to plant and equipment**
- **Employer and employee associations should publicise the levels of noise generated by the various types of plant and equipment**

References (1)

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