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NOISE AND HEARING LOSS IN THE LOGGING INDUSTRY

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INTRODUCTION

Much has been done in recent years to analyse and reduce accident frequency in the logging industry. Less publicised and equally important is the impact of occupational disease; the most common being noise induced hearing loss (NIHL).

Noise, unlike other occupational hazards represents a direct impulse of physical energy upon the individual. It continues to be a hazard at work, at home, and even during sleep.

Acute disease or accidents require immediate attention and work stoppage but chronic problems, such as NIHL, with long latency have long term implications for worker and employer.

Because NIHL is subtle and cumulative, guidelines governing noise exposure are complex.

DAMAGE RISK CRITERIA

The present damage risk criteria in New Zealand are based on the premise that NIHL will occur only if there is a continuous exposure over an eight hour day to a noise level in excess of 85 dBA.

If the noise exposure occurs for only part of the day (i.e. it is intermittent), then it is necessary to consider all of the spells of noise throughout the day to arrive at what is called "an equivalent continuous level" for an eight hour period.This is known as Leq (8 hours). If the Leq exceeds 85 dBA then a noise hazard exists.

Referring to Table 1, it can be seen that an increase of 3 dBA - a doubling of sound energy - requires a halving of the exposure time to stay within the damage risk criteria.

Even at exposure of 85 dBA at least 10% of the population will still incur noise damage.

Susceptibility to noise depends on:

(a) Loudness
(b) Pitch
(c) Exposure time
(d) Distance from source
(e) Surroundings
(f) Age, heredity, ethnicity

HOW DAMAGE OCCURS

Noise is unwanted sound.

Sound is a vibration which travels most easily through air. It is channelled in via the pinna, or outer ear, along the external

Table 1 : Maximum Permissible Daily Noise Exposure

Duration per day	Noise Level (dBA)
8 hrs	85
4 hrs	88
2 hrs	91
1 hr	94
30 mins	97
15 mins	100
8 mins	103
4 mins	106
2 mins	109
1 min	112
30 secs	115

ear canal towards the eardrum. From there it passes along the three bones in the middle ear, and vibrates in the oval window - a thin membrane stretched across the entrance to the inner ear. The inner ear, or cochlea is lined with cilia, or hair cells which transmit sounds via the 8th cranial nerve to the brain.

When a person is exposed to excessive noise the hair cells become stressed and Temporary Threshold Shift (TTS) occurs, i.e. the level at which noise is first heard is raised. If there is at least 8 hours rest from noise then the threshold recovers. If there is insufficient rest and exposure is repeated, then the threshold shift becomes permanent (PTS). Hearing ability is then lost because the hair cells are destroyed and do not regenerate. This loss is termed sensorineural as opposed to conductive loss, the latter occurring because there is mechanical interference to the passage of sound along the auditory pathway. Noise is the most common course of sensorineural loss.

The cilia of the inner ear are stimulated by the movement of the basilar membrane relative to the tectorial membrane. According to the Place Theory of Hearing, cilia at the basal (closest to the middle ear) end of the cochlea are stimulated by high frequencies and at the apical end by low frequencies. This is why high frequency hearing tends to be damaged first.

Noise damage is gradual, painless, and permanent.

OTHER EFFECTS OF NOISE EXPOSURE

Besides the effects of noise to the ear, there are other related problems with communication and social relationships. The ability to cope at work can be seriously affected; high noise levels can potentiate other hazards.

Noise causes vasoconstriction, resulting in depletion of oxygen to body tissues leading to fatigue and impaired concentration. This may predispose towards injury or a wrong decision resulting in a decrease in volume or log value because a wrong cut was made. Some research has correlated a relationship between NIHL and vibration white finger (VWF).

NOISE IN LOGGING

Sound level surveys have been conducted by various organisations on a number of chainsaws. While many saws idle at less than 85 dBA, at full load or racing the noise levels may be between 103 - 113 dBA. While exposure levels would indicate that Grade 5 protection be worn, the maximum protection available with a hardhat/earmuff combination is Grade 4. The efficiency of a hardhat/muff combination is downgraded by a number of factors, a major reason being the decreased clamp force.

The high level of noise from chainsaws, skidders and other logging machinery still causes noise damage for some loggers, which emphasises the need for an effective ongoing hearing conservation programme within the industry.

A programme was carried out by the Rotorua Health Development Unit on 34 contract logging gangs; a total of 224 workers. The programme took some time to complete because of the distances to travel between gangs; a point which emphasises the isolation from occupational health services for many of the country's forest workers.

As part of a hearing conservation programme, health education on noise and hearing loss was given to each gang, with individual counselling on the use of hearing protection devices (HPDs). While those working with chainsaws were aware of the hazard, loader operators were less aware, especially of the fact that the noise level increases as the machines get older owing to loss of soundproofing in the cab.

The hearing testing was done using a portable screening audiometer, and loggers were tested on site with all machinery stopped or well away from a noisy work site using the cab of a truck as a soundproof enclosure. Testing was done as early in the day as practicable to get the most accurate reading. The number of hearing defects were correlated with age and years in production forestry. A careful work history was taken, and the term "production forestry" was used to cover the various tasks in logging - machine operator, skiddy, cross cutter, breakerout, etc. as many loggers had done a variety of tasks.

The number of referrals is the number of people who had a loss greater than 45 dB at 4000 Hertz (Hz), and/or a loss of 50 dB at 6000 or 8000 Hz who chose to be referred under Accident Compensation Corporation for investigation. Some who met this criteria decided against referral.

"Total Defects" includes all who had a referrable hearing loss; those who had a sensorineural loss of 40 dB or more; and a few whose hearing loss was non-occupational.

The proportion of people with hearing loss increased both with age and years in production forestry. The high noise levels of forestry machinery may still be causing hearing loss despite good compliance with using HPDs.

In 1986 the results of a survey on chainsaw noise showed that with some saws even the Grade 4 hard hat/muff combination was insufficient to prevent hearing loss.

Table 2

Age Group	No. of Persons	Total Defects	Referrals
Under 30 yrs	94	22 (23.4%)	5
30 - 39 yrs	81	39 (48%)	17
40 - 49 yrs	38	29 (76%)	11
50+ yrs	11	11 (100%)	4
	224	101	37
Age Range: 18 - 60 yrs		Mean: 34.25 yrs	

Years Forestry	No. of Persons	Total Defects	Referrals
5 yrs or less	53	10 (18.9%)	3
6 - 10 yrs	58	25 (43%)	9
11 - 15 yrs	49	21 (43%)	5
16 - 20 yrs	31	17 (55%)	6
21 - 25 yrs	16	13 (81%)	6
26 - 30 yrs	13	11 (85%)	6
30+ yrs	04	04 (100%)	2
	224	101	37

The implementation of a hearing conservation programme with regular audiometry can effectively discover and monitor the extent of noise injuries. The relationship between NIHL and possible contribution to accident rates could be investigated.

Evaluation of the HDU hearing conservation programme is planned, with retesting of the 34 logging gangs.

HOW TO IMPROVE HPD PERFORMANCE

Engineering controls are the first steps in noise reduction. This includes:-

(a) Chainsaw maintenance

(b) Machinery maintenance - maintenance of loaders and other heavy machines. Comfort cabs reduce noise levels and increase productivity by reducing fatigue.

(c) Maintenance of HPDs.

A vital aspect of HPD use is not just having the correct grade of HPD but also knowing how to maintain it to best effect.

When an HPD is fitted under ideal conditions air leaks are minimised. In real world conditions this does not often happen, and air leaks reduce attenuation by 5 - 15 dB over a range of frequencies. Reasons for poor use can be overcome.

(1) *Comfort*: The better the fit the poorer the comfort is the general rule. Individual fitting will overcome the problem of non-acceptance.

(2) *Poor training*: Many HPD users are not aware that hair under cushions or glasses frames will cause air leaks.

(3) *Fit*: This is extremely important. Earmuff cushions must fit completely around the ear.

(4) *Compatibility*: No one brand of muff will suit every head shape or ear size. Workers should be allowed to choose their own muffs of the right grade.

(5) *Deterioration*: HPDs wear out, particularly in bush work where they are exposed to ultraviolet light, oil and dust. Ear cushions harden and crack, and become permanently deformed. Clamp force is lost. Frequent inspection and replacement is important.

CONCLUSION

The specific nature of working conditions within forestry influences the health status of forest workers. While attention is given to accident prevention and training, the effects of occupational disease must not be overlooked.

Noise as a health and safety hazard continues to be a problem in logging. HPD use is essential but this in itself may not prevent some damage occurring. Engineering controls must be the prime objective.

A hearing conservation programme is beneficial to workers and managers as it helps highlight potential problems and institute appropriate controls. it also allows workers to utilise a health promotion programme which because of their isolation they do not otherwise have access to.

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