Occupational Noise and Solvent Exposure in the Printing Industry

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Abstract: The effects on hearing from occupational noise and solvent exposure in the printing industry were studied by measuring a selection of workers’ personal daily noise dose and exposure to solvents and conducting audiometric tests before and after their shifts for the detection of hearing threshold shifts. Audiometric tests were inconclusive due to inadequate testing areas provided in each workplace. The results confirmed that where solvent exposure occurs high noise levels are usually also present. Of the noise dose measurements 53% exceeded the Statutory limit of $L_{Aeq,8h} 85$dB(A). A further 9% exceeded 140 dB Peak (Lin). Of the analysed solvents 22% revealed the presence of benzene of which 5% exceeded Worksafe Australia’s exposure standard of 16mg/m$^3$. The lack of essential information in Material Safety Data Sheets (MSDS’s) for substances used in the printing industry was highlighted. Manufacturers/suppliers are required to provide accurate MSDS’s so that employers can discharge their obligation to provide information to their workers and enable them to use the hazardous substances safely.

INTRODUCTION:

Sensorineural hearing loss usually begins with trauma to the haircells in the cochlea and auditory nerve. The most common causes are are; noise exposure, ageing, ototoxic drugs and inter actions between these agents (Mills, 1985). To date, research into ototoxic drugs and hearing loss concentrated mainly on antibiotics, diuretics and salicylates, with research largely based on animal studies (Morata, Dunn, Kretcher, Lemasters & Keith, 1993). Sataloff and Sataloff (1993), stated that roughly 200 drugs and agents have been reported as ototoxic and of particular concern is the multitude of solvents commonly used in industrial settings.

Workers in the printing industry use a range of solvent based products in printing processes. Research into industrial solvent exposures usually relates to their neurotoxic effects including; headaches, dizziness, fatigue, and brain functions, etc (Macfie, 1996; Boor & Hurtig, 1997; Ng, Ong, Lam, & Jones, 1990; Morata et al, 1989). Recent research suggests that chemical agents which are toxic to the nervous system are also ototoxicants and as such can damage the sensory cells and nerve endings of the cochlea (Morata et al, 1993; Macfie, 1996; Spencer et al, Barregard and Axelson, 1984; Fetcher, 1995; Sataloff & Sataloff, 1993).

A study by Morata et al (1993) on the relationship between exposure to noise and solvents in the printing and paint manufacturing industries revealed through pure tone and impedance audiometry, and stapedius reflex testing, a larger relative hearing loss after exposure to solvents and noise than after exposure to noise alone (Phaneuf & Hetu, 1990), found in a study on trichloroethylene exposed workers that the 7th cranial nerve may be affected. As this nerve also controls the stapedius muscle and its reflex action, the susceptibility to NIHL may be increased.

METHODOLOGY

A pseudo random selection generated a list of 50 printing workplaces faking under the Australian/New Zealand Classification (ANZIC) codes 2411 and 2412. From this list 25 workplaces were randomly selected and then visited to determine suitability for participation in the study. Criteria included; workprocesses involving offset or form printing, a demonstrated use of solvents in the printing process, and selection of sample of small (<10), medium (10-20) and Large (>20) workers. In total 19 workplaces (5 small, 7 medium and 7 large) participated.

A selection of workers were chosen at each workplace to wear a noise dose meter or a personal sampler pump to measure hydrocarbons. Selection was based on the number of workers at the workplace, the location of the operators and the likelihood of exposure to either solvents or noise. Audiometric tests were performed before and after the shifts. Monitoring of noise exposures was done with Bruel and Kjaer Type 4436 noise dose meters. Solvent monitoring was done using SKC model 222-3 low flow personal air sampling pumps calibrated to 40ml/min for a period of 4-8 hours. Analysis of the samples was conducted by a Government laboratory. Audiometric tests were made before and after each shift, using a Dampex Screening Audiometer Type AS 63 in accordance with the procedures in Appendix E of AS 1269 "Acoustics-Hearing Conservation".
RESULTS

Noise: Forty nine noise dose level measurements were obtained from the 19 workplaces under study. Results from the personal monitoring confirmed that where solvent exposure occurs in the printing industry, high levels of noise are usually also present. Fifty three % of the obtained measurements exceeded the Statutory exposure limit of $L_{Aeq,8h}$ 85 dB(A) by 6 to 14.34 dB(A). A further 8 % of these measurements were between 84 and 85 dB(A). Further, 9 % of the measurements exceeded the Statutory limit of 140 dB Peak (Lin), with a further 57 % exceeding 130 dB Peak (Lin).

Solvents: Fifty five samples were taken using the personal sampling method. Analysed results showed the presence of Xylene, Toluene, Hexane, Heptane and Octane. The aromatic hydrocarbon benzene was present in 12 of these samples with 3 samples over the Worksafe exposure standard of 16 mg/m$^3$ by 4 to 11 mg/m$^3$.

MSDS: Of most of the MSDS’s available at the workplaces of this study, the information contained in them did not meet the requirements for MSDS’s. The MSDS’s for the products used daily during most work processes, contained little information about the properties of the product or health hazard information. In most cases the properties were listed simply as a blend of aromatic or aliphatic hydrocarbons, hence not actually indicating the presence of the human carcinogen benzene. It was also found in one workplace that while the personal sampling detected toluene (an aromatic hydrocarbon) in the workers’ breathing zone, the MSDS for the product being used, while the sampling was taking place, described a product consisting of 100 per cent aliphatic hydrocarbons.

Audimetry: Audiometric testing was conducted at five of the 19 workplaces included in this study. The tests were however, influenced by background noise levels at each workplace and therefore the results were invalid. The so-called ‘quiet’ areas provided for testing were not adequate and external noise levels too high (ie. traffic from outside, and other activity at the workplace) to comply with the maximum background levels prescribed in Appendix E of Australian Standard 1269 for audiometric test rooms. It was anticipated that any further testing at subsequent workplaces would be influenced by the same background noise and therefore yield invalid results. Therefore no further audiometric testing was conducted at subsequent workplaces.

Disclaimer: The views expressed in this paper are those of the authors and not necessarily those of the Workplace Health and Safety Program.

REFERENCES