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Real world use and performance of hearing protection

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Real world use and performance of hearing protection

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This report considers the effectiveness of hearing protectors in everyday work situations. The study reported here was undertaken in two parts. The first consisted of interviews with employers to discuss management of noise and hearing protector use, and on site observation of hearing protector use. The purpose of these visits was to see:

- how well hearing protection was used;
- the training provided;
- the use of other PPE and equipment that may limit attenuation;
- behavioural factors affecting use, taking into account the noise exposure of employees and the environment in which the hearing protection is worn.

The second part was objective laboratory measurements of hearing protector insertion loss. The purpose of these measurements was to quantify the reduction in protection due to poor fitting or maintenance for a range of hearing protectors. Earmuffs were tested using the MIRE (microphone in real ear) method while earplug insertion loss was measured using a head and torso simulator with a simulated pinna and ear canal.

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EXECUTIVE SUMMARY

Objectives

Hearing protection effectiveness is normally estimated from laboratory test data. HSE requested the Health and Safety Laboratory consider the effectiveness of hearing protectors in everyday work situations. This study was undertaken in two parts. The first consisted of interviews with employers to discuss management of noise and hearing protector use, and on-site observation of hearing protector use. The second part was objective laboratory measurements of hearing protector attenuation to quantify the attenuation lost due to factors including poor fitting or maintenance.

Main Findings

Three of the twelve companies that allowed on site observation of hearing protector use during normal working, and one out of four groups of outdoor workers seen had problems with ensuring correct use such that the hearing protection use was ineffective (nil protection) for all or the majority of workers. In addition in premises where the majority of workers were seen making effective use of hearing protection one in seven workers were still seen to be not using hearing protection when and where its use was required. This proportion suggests that possibly only 60% of workers supposedly using hearing protection are in fact protected.

Reduced audibility was a common reason given by users for not wearing hearing protection. None of the employers seen were aware of the availability and benefits of flat response, communication and sound restoration hearing protectors.

Hearing protection was also seen in use where there was no risk. One employer had set an entire building as a hearing protection zone even though quiet areas work areas were included. Another employer also considered he should issue hearing protection as a blanket measure rather than assessing the actual risk.

All employers visited by appointment were providing hearing protection of a suitable type for the work environment and compatible with other personal protective equipment (PPE) worn. Hearing protection was visibly in a good condition apart from extremely dilapidated earmuffs that were the only protection supplied by one employer. In two out of four unplanned encounters with outdoor workers earmuffs were worn over clothing or other PPE that would have resulted in reduced attenuation.

Less than half of employers supplied hearing protection as part of a comprehensive noise control programme or selected hearing protection according to the attenuation required. As a consequence most heavy-duty hearing protection used would be predicted to provide too much protection (over protect). Only two workers were seen wearing hearing protection predicted to provide insufficient protection (under protect) according to the manufacturers' data.

Employers requiring earplugs with metal tracers were unable to source mid or low attenuation devices. Available earplugs containing tracers all provided high attenuation

80% of the employers visited provided some training on the use of the hearing protection provided. One group of outdoor workers had also received training. The type of training varied from simply the provision of written instructions to hands-on training in small groups.

Compressible foam earplugs were poorly fitted by just over half of the users seen. Most users were unaware of how to compress the earplug before fitting. Laboratory tests showed incorrectly compressed earplugs may not fill the ear canal when fitted resulting in a measured SNR of 9dB or less. Moulded or foam push in type earplugs were said by users to be easier to fit and were generally observed to be well fitted.

Laboratory tests showed earmuffs deteriorate with use due to reduced headband tension likely to result in under protection in some real world conditions without obvious visible deterioration of the earmuff.

RECOMMENDATIONS

Hearing protection is often considered as the first and only solution where a noise risk exists. Users need to be aware that it is not a simple or reliable solution.

Most employers did not select hearing protection according to the attenuation required. It would be beneficial if information on the approximate upper and lower sound levels for which the protector is likely to be suitable was included on the hearing protector packaging and with any advertising. The information could take account of likely real world attenuation. This information could be provided in addition to the attenuation data currently provided.

A maximum lifetime, in terms of approximate duration of use, should be provided for all reusable hearing protection. Hearing protector attenuation deteriorates with use and this deterioration may not be apparent to the user.

Compressible foam earplugs are generally poorly fitted, as users are generally unaware of how these should be compressed before fitting, or unaware of the importance of correct compression. An incorrectly compressed earplug may give virtually no attenuation. Correct use requires a high level of training, supervision and motivation. Employers providing this type of protection, and users, need to be aware of these potential problems, and of the existence of alternative types of earplug such as the foam push-to-fit type.

There needs to be greater awareness of the types of protectors that can assist audibility and communication.

Earplugs with tracers are required in a wider range of attenuation than is currently available.

There is a need for clothing compatible with correct earmuff fitting for outdoor workers. Earmuffs worn over conventional hats and hoods can only provide limited attenuation.

1 INTRODUCTION

This report considers the effectiveness of hearing protectors in everyday work situations. The study reported here was undertaken in two parts. The first consisted of interviews with employers to discuss management of noise and hearing protector use, and on site observation of hearing protector use. The purpose of these visits was to see:

- How well hearing protection was used;
- The training provided;
- The use of other PPE and equipment that may limit attenuation;
- Behavioural factors affecting use, taking into account the noise exposure of employees and the environment in which the hearing protection is worn.

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2 METHOD FOR EMPLOYER INTERVIEWS AND OBSERVATION OF HEARING PROTECTOR USE

Employers were contacted by telephone and asked if they used hearing protection, and if they would be willing to help with this study. Fifteen employers agreed to help, and all of these were interviewed on hearing protector use at their premises. Out of these fifteen, thirteen gave access to working areas to observe hearing protector use. Of the two who did not allow access: one only had dispersed outdoor teams using hearing protection, and one could not allow access for hygiene reasons.

The participating employers consisted of four small premises with no more than 10 staff working in noisy areas, six medium size employers with no more than 100 staff on site and five employers with more than 100 employees on site. The premises are listed in Table 1.

Interviews were arranged by appointment with a manager or safety officer. In some cases they were able to provide their noise risk assessments or safety files for additional information during the interview.

The following topics were considered during the interviews:

- Choice of hearing protection
- Factors considered in hearing protector choice
- The availability of the hearing protection
- Other head-worn clothing and PPE used with hearing protection
- Problems associated with hearing protector use
- The training and consultation of staff on noise hazards and hearing protection use
- Maintenance of correct hearing protector use
- Other noise controls
- Results of health surveillance if used

Where possible a visit was made to noisy working areas after the interview. These visits were normally accompanied by the person seen in the interview or by a works supervisor. Hearing protector use was checked visually, noting the type, how well it was fitted, and how consistently it was used. Checks of noise levels in work areas were also made. Where possible individual employees gave their views on hearing protector use, but in some premises employees were reluctant to speak about this.

In addition to these planned visits to employers, four unplanned encounters with outdoor workers seen using earmuffs are included in this report.

Table 1 Summary of hearing protection and conditions at premises visited and for outdoor workers seen

Full site visit details are provided in an appendix at the end of this report. References to the relevant appendix subsections are given in the table.

Note – the single number rating (SNR) value is provided for all CE marked hearing protectors (HP). The manufacturer's quoted SNR values are shown in the table below. The SNR provides a simple estimate of the protection when corrected for the frequency content of the noise.

Appendix	*Site*	*HP and PPE available*	*SNR*	*HP fit/ condition*	*Sound level where HP used dBA*	*Training*	*Availablity*	*Maintenance*	*Health Surveillance*
9.1	Vehicle brake manufacturer 650 employees 50 to 60 working in >85dBA each day 150 to 200 with custom moulded earplugs	Neckband earmuff Over head earmuff Foam earplug Flanged earplug Flanged earplug Custom moulded	31 30 37 25 30 Variable	Not seen 1 well fitted 3 poor, 1 well fitted Not seen Not seen 5 well fitted 3 no HP	91 86 to 91 85 to 90 86 to 87	With induction	Earplug dispensors Earmuffs on request Custom moulded where HP compulsory	Custom moulded serviced annually 70 staff on Dupont Stop Oberservation programme Radios or personal stereos banned hearing protection zones where >85dB(A)	No NIHL reported
9.2	Metal fabricated buildings manufacturer Employs 40 in factory, 10 outside	Banded earplugs Flange earplug + visor Flange earplug Custom moulded + visor Foam earplug Over head earmuff	23 30 30 23 33 27	Not seen 3 well fitted 4 well fitted 4 well fitted 1 poor fit 3 well fitted	82 95 82 106 81 81 to 82	Training within last month in groups of about 6 noise control fitting care of HP	Custom moulded to all staff earplug dispensors	Whole area hearing protector zone Radios still to be dealt with Noise assessment made	Just started No results yet
9.3	Bottling plant (plastic bottles only) 80 staff working shifts Working 4 x 12 hour days every 8 days No hygiene restriction on choice of HP	Foam corded earplug Foam corded earplug Earmuffs (engineers) Hair nets and hoods worn	34 35 Unknown	HP not required due to plant shut down	<75 85 to 90 when running	With induction	Dispensors and hand washing at entrances	> 85dB HP zones Shift leaders do daily safety checks Regular safety audits	Only fork lift drivers No details
9.4	Vehicle servicing and repair centre 10 staff seen 8.5 hour day	Over head earmuffs with goggles Foam earplugs with respirator	26 37	Only seen used after instructed by safety officer User unable to fit	95 to 98 when using power tools	With induction plus written instructions Said by safety officer to be ineffective	New earmuffs on show but not enough to go round	None	Body shop staff only NIHL reported
9.5	Joinery workshop 4 employees 8 hour working day	Two pairs of broken earmuffs shared between staff	Unknown	Ineffective due to severe damage	85 to 91 when using machines	None	No replacement HP	None	None
9.6	Vehicle accident repair centre 10 employees in workshop	Foam earplug Overhead earmuffs Visors, goggles, and safety glasses also used	28 27	Moderate fit Not seen in use/ moderate condition	Bgd 72 HP used with power tools	External safety training on PPE and safe use of tools	Earplug dispensers Personal issue of earmuffs	PPE checked every month Tools requiring HP identified Purchasing quiet tools 6 monthly health and safety meeting Aware problems getting staff to use protectors	All staff No NIHL reported
9.7	Iron work restoration 19 employees on shop floor	Overhead earmuff Overhead earmuff Foam earplug Helmets with integral earmuffs used off site Eye protection also used	27 24 28	1 poor fit Not seen 1 moderate fit Not seen	Bgd 76 to 78 HP used with power tools	With induction including when and why HP required	Personal issue of earmuffs Staff had supply of earplugs	Registar of issue, regular replacement procedure Buying quiet tools	None

Table 1 (continued) Summary of premises visited and outdoor workers seen

Appendix	*Site*	*HP and PPE available*	*SNR*	*HP fit/ condition*	*Sound level where HP used dBA*	*Training*	*Availablity*	*Maintenance*	*Health Surveillance*
9.8	Printers 6 employees seen in print room	Overhead earmuff Foam earplug	25 36	1 poor fit	81 to 83	No training	Personal issue of earmuffs Supply of earplugs	Signs on machines	None
9.9	Confectionary manufacture Over 600 employees	Earmuffs used by engineers Foam earplug Foam earplug	Unknown 32 36	No access to factory area	<80 to 95	Training on induction	Not seen	Not seen	None
9.10	Joinery factory 82 employees	Overhead earmuffs Foam earplug with rigid centre Flanged earplug Use earmuff covers when hot and sweaty	30 23 30	Well fitted Poor or deliberate misfit Moderate to well fitted 90% with HP	85 to 100	Training on use of HP when first provided, risks explained around factory	Foam earplugs at entrance	Ineffective - most users wearing foam earplugs in outer ear outside ear canal	None
9.11	Small plant manufacturer 125 on shop floor, 95 in noisy areas	Foam earplug with rigid centre Foam earplug with rigid centre Foam earplug Flange earplug Foam earplug with rigid centre Foam earplug with rigid centre Foam earplug Flange earplug No hearing protection	29 27 28 30 29 27 28 30	None seen 3 good, 2 poor fit 2 poor fit 2 moderate fit None seen 7 moderate to good fit and 2 poor fit 2 good fit 2 good fit 10	73 to 75 73 to 75 73 to 75 73 to 75 84 to 92 84 to 92 84 to 92 84 to 92 84 to 92	Induction, and ext consult ant runs training every 2 months Risk assessments for all work	Earplug dispensers at entrance for foam plug with rigid centre and EAR classic	Monthly safety audits by external facilitator	Just started for 85% of workers
9.12	Small sheet metal workshop 4 to 5 staff on shop floor	Foam earplugs with rigid handle Earmuffs	35 28	2 good fit Good condition not in use	80 to 85	No training. Staff said they knew how to use hearing protection	From workshop office		
9.13	Local Authority (office interview) Countryside service (chainsaws, brush cutters and strimmers) Highway maintenance	Combination visor, helmet and earmuffs Earmuffs EAR banded	Unknown 26 23	Not seen in use		Training demos on how to fit All road workers trained in last 12 months Planning 1 week induction training for new road workers Looking at refresher		Policy to buy low vibration tools No noise policy Said supervision on site is weakest link Audibility a problem esp. highway maintenance	Voluntary in last 3 years plus referral where cause of concern (eg claim) NIHL found
9.14	Pressure system component manufacture Hot pressing Machining putting together 3 shift system 24 hour operation	Earmuffs Flanged earplug Foam	27 30 28	All using earmuffs or earplugs well fitted	83 to 98	Induction Use printed instructions for fitting No checking of actual fit or hands on training	No dispensers seen	HP zones clearly marked	

Table 1 (continued) Summary of premises visited and outdoor workers seen

	Site	*HP and PPE available*	*SNR*	*HP fit/ condition*	*Sound level where HP used dBA*	*Training*	*Availability*	*Maintenance*	*Health Surveillance*
9.15	Cement works 150 on site including contractors Problem with both noise and dust	Foam earplug Flanged earplug Custom moulded (on trial) Foam earplug with rigid stalk Earmuff helmet mounted Earmuff helmet mounted Eye protection, dust masks, hard hats also worn on site	28 28 38 30 34	Unseen Unseen Unseen Unseen Unseen Good fit, dusty condition	 89 to 94	Induction Tool box talks every 6 months Don't actually show users how to fit	Foam earplug dispensors at entrances to noisy areas	Supervisors and colleages will check on hearing protection Managers and supervisors have additional safety training	Just started this year NHL found
9.16	***Outdoor workers***								
	Grounds maintenance Strimming	Helmet, visor and earmuff combination	Unknown	Good fit and condition	95				
	Grass cutting, mower and strimmer self employeed gardener	Optime III over head	35	Good fit and condition	90 to 95	Advice from health and safety advisor (personal friend)			
	Community punishment team	Unidentified overhead earmuff for wearing with visor	Unknown	Good condition, not used	95 (subjective estimate)	Initial safety training provided	Only one pair available for 3 workers using strimmers	Earmuffs were shared and not issued to individuals. None Team members hygiene concerns prevented use but were considered unimportant by management	
	Road maintenance 2 workers private contractor	Earmuffs over cap, jacket hood. and eye protection Earmuffs over fleece hat mask, eye protection	23 31	Poor fit and condition, seals cracked, no band tension Good condition, poor fit	97 107	No training	No alternative protectors available	None known to workers seen	