

## TECHNICAL NOTE

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### SUMMARY

Information is provided on assessing the noise exposure levels of forest operations, noise protection standards and ways of reducing noise levels. Guidance is given on selecting the personal protective equipment that is most appropriate for particular levels of hearing protection, including a list which identifies appropriate PPE for a wide range of forest operations and machine types.

### INTRODUCTION

This Technical Note uses current information gathered from manufacturers and suppliers of equipment, together with limited noise measurements obtained from machinery studies, to assess the noise exposure levels of forest operations. From evaluation of these data, guidance is given on the selection of appropriate personal protective equipment (PPE). Loud impact or explosive noises, for example those from rifles, are not covered.

More detailed guidance on regulations and assessment procedures can be found in *Noise at work – guidance on regulations* (Health and Safety Executive, 1989).

### NOISE PROTECTION STANDARDS

#### Current standards

The definitions and requirements of current standards (January 2002) are as follows:

#### Definitions

- **Daily personal noise exposure:** the total noise exposure throughout the working day expressed as an average noise level over 8 hours. This level is expressed as dB(A).
- **First action level:** a daily personal noise exposure of 85 dB(A).
- **Second action level:** a daily personal noise exposure of 90 dB(A).

- **Peak action level:** a level of peak sound pressure of 200 pascals (Pa). This is used when workers are exposed to infrequent but loud impact or explosive noises, for example those from guns or cartridge operated tools.

#### Requirements

As at October 2002, if the daily personal noise exposure level is at or above 85 dB(A) then hearing protection must be made available and, where possible, action must be taken to reduce the level. Noise exposure in excess of 90 dB(A) must be regulated by engineering control or personal protection to a level below 90 dB(A).

Although the action level refers to the 'average' exposure over the whole working day, the length of the exposure can be of limited significance as halving the exposure time only reduces the daily personal exposure by 3 dB(A).

#### Proposed new standards

The EU Physical Agents Directive has proposed that the figures in the current standard should be reduced, with a proposal that they should be adopted. The UK would have to implement the regulations within 3 years from the adoption in Europe.

The proposed standard revises the figures to:

- **First action level:** a daily personal noise exposure of 80 dB(A).
- **Limitation on personal daily noise exposure** of 87 dB(A).

This Technical Note gives guidance on the selection of PPE according to the existing and the proposed standards being applied.

## MEANS OF REDUCING NOISE EXPOSURE LEVELS

Several actions must be considered before resorting to the use of PPE. These are:

- assessing and measuring worker exposure;
- reducing risk by technical or organisational means;
- informing and training workers.

If these measures still do not reduce noise exposure levels sufficiently then the provision of PPE, normally in the form of earmuffs, needs to be considered.

### Assessing and measuring worker exposure

As a general guide, if you cannot hold a conversation at a 2 m distance then an assessment should be made. If there is any doubt about the level of noise exposure or appropriate action to take, then noise measurement and assessment should be undertaken. This needs to be carried out by someone who is competently trained in such assessments.

### Reducing risk by technical or organisational means

It may be possible to reduce the noise level experienced by the operator, for example:

- Identifying alternative equipment or means of doing the job.
- Reducing the noise at source, for example by soundproof enclosure around the machine or other means of muffling.
- Moving the noise source further away from the operator.
- Reducing the time the operator is exposed to the noise (job reorganisation).
- Providing noise insulation such as quiet cabs and quiet areas for operators.

### Informing and training workers

It is essential to ensure that workers are fully trained in the selection, use and maintenance of PPE appropriate to their work requirement (see Use and care of hearing protectors, page 6).

## SELECTING PERSONAL PROTECTIVE EQUIPMENT

### General guidance

Appropriate earmuffs are needed for different levels of hearing protection. The use of earplugs in the forestry environment could increase risks of ear infection if particular care is not given to hygiene. Their use is therefore only advised if there is a medical or other reason for not using earmuffs (see page 6). The PPE identified in Table 1 give very good protection for a wide range of forestry operations. There are options available in Tables 2 and 3 which give higher levels of protection and should meet all forestry requirements.

All equipment references in the Tables 1, 2 and 3 relate to earmuffs that are compatible with European Standard EN 352 Part 3 for helmet mounting. Equipment must be compatible with any helmet having a standard 30 mm slot mounting. Although normally there is interchangeability between earmuffs in terms of helmet mountings, this does not apply to eye protection visors. Visors are commonly matched to earmuff types and therefore not interchangeable between different brands. Providing a user selects a single manufacturer for both ear and eye protection, differing earmuffs may be interchanged to suit a wider range of environments.

### Noise protection levels

Tables 1, 2 and 3 list hearing protectors, each table relating to similar levels of Standard Noise Reduction (SNR) for selected equipment. SNR is an *approximation* of the hearing protection given, i.e.

$$\text{noise level (dB)} - \text{SNR of PPE} = \text{noise level at operator's ear (dB(A))}$$

(Note the SNR must be subtracted from the noise level in dB to give the noise level at operator's ear in dB(A).)

The *actual* protection achieved will vary according to the frequencies emitted by individual machines. If a more accurate assessment of protection is required then an understanding of frequency attenuation is needed and the assessment should be undertaken by trained personnel with specialist noise measuring equipment.

**Table 1** Examples of lower level protection equipment

Earmuff type	Protector EC8	Bilsom 818 NST	Peltor H31P3
SNR dB	26	26	28

**Table 2** Examples of PPE at a higher performance level

Earmuff type	Protector EC10	Bilsom 848 NST	Peltor H7P3
SNR dB	29	30	30

**Table 3** Examples of PPE at the highest performance level

Earmuff type	Protector EC12	Peltor H10P3
SNR dB	32	34

**Example 1**

If the noise emission level of a machine is 105 dB

The SNR of the Protector EC8 muff (Table 1) = 26

The Protector EC8 will therefore reduce the noise level at the operator's ear to approximately 79 dB(A) and therefore provide adequate protection.

**Example 2**

If the noise level of a machine is 109 dB then none of the PPE from Table 1 will reduce the noise level below 80 dB(A).

Any of the PPE from Table 2 would provide adequate protection, for example Bilsom 848 would reduce the noise at the operator ear to approximately  $109 - 30 = 79$  dB(A).

It should be noted that the new standard (EU Physical Agents Directive) asks for the exposure to be below the limit value of 87 dB(A).

**Problems caused by over-specifying noise protection requirements**

Allowing operators to hear some residual ambient noise may be appropriate and may in fact increase safety. For example, when felling, an operator is required to have the ability to hear crashing trees or branches, or to hear whistles from a colleague who may need assistance. It is therefore important to fully consider the other safety needs with regard to hearing and not to over-specify the noise protection requirement.

**Consideration of exposure time**

As noise exposure level is a function of both the noise emission levels of the machinery and the exposure time, a reduction in exposure time alone may reduce the type of PPE necessary to reduce the exposure to an adequate level. A halving of daily exposure time results in an approximate reduction of 3 dB(A) personal exposure (Example 3).

**Example 3**

If the noise emission levels of a machine averaged 87 dB(A) over the working day then if the machine was used for only 4 hours the daily personal exposure would be approximately 3 dB(A) less, i.e. 84 dB(A). Although this is less than the current first action level, it is only marginally so.

It is recommended therefore that PPE is used, irrespective of the working time, unless specific noise measurements and exposure times are obtained and the daily personal noise exposure fully assessed.

**Consideration of variations between different models of similar machine types**

Table 4 sets out a range of noise emission levels for different machine types and forest operations, and a guide to the appropriate PPE. The range is due to the variations between machine models, i.e. one model may have a lower noise level than another. Table 4 identifies the PPE required to give the maximum protection which may be needed for that range of machinery. If it is considered that the machine has a noise level at the lower end of the range, and therefore a lower level of PPE may be appropriate, this should be verified by actual noise and exposure time measurement. In Example 4, appropriate PPE is identified for a hand-operated machine.

**Example 4**

Posthole borers can have noise levels from less than 80 dB(A) up to approximately 98 dB(A). The quietest examples may not require any PPE but this should be verified by noise measurement. If noise measurement is not undertaken then PPE from Table 1 should be selected and used.

## Identifying appropriate PPE for different machine types and forest operations

Table 4 identifies appropriate PPE for different machine types and forest operations. The guide assumes that the exposure to noise is over the full working day and noise levels over that period are the maximum indicated by the table.

If you consider that the noise levels may be significantly less than those indicated in Table 4, or exposure time is significantly less than the full working day, then an individual assessment should be undertaken before reducing the PPE requirement identified.

Table 4 excludes mechanical and civil engineering operations. Note that when Q cabs are fitted to any machine and the operator is fully protected by having all windows closed then PPE is not required to meet *current standards*. Some machines with Q cabs will not provide protection below the proposed *future action* level, although the protection will ensure noise levels are below the *future limit*.

The advisory PPE assumes protection is required against the highest level of noise from machines as shown in ‘noise value indicated’. If manufacturer’s data or actual measurements are available to show lower noise levels then reduction in PPE specification may be appropriate.

**Table 4** Guide to identification of appropriate PPE for forest operations and machine systems

Machine type or forest operation	Basic category description	Operating position (if affecting)	Noise value indicated (dB(A))	Table number from which PPE should be selected	
				Current standard limits applicable	Future standards applicable
<b>Harvesting</b>					
Harvester/processor	Purpose-built base	In wood or at roadside	67–75 With protection of Q cab	*	*
	Excavator base	In wood or at roadside	75–83 With protection of Q cab	*	1
	Agricultural tractor base	In wood	<85 With protection of Q cab	*	1
Forwarder	Purpose-built base	In wood or at roadside	70–83 With protection of Q cab	*	1
	Agricultural tractor base	In wood or at roadside	c. 80 With protection of Q cab	*	1
Skidder	Purpose-built base	In wood or at roadside	87–92 Outside Q cab	1	1
	Agricultural tractor base	In wood or at roadside	<90 Outside Q cab	1	1
	Agricultural tractor Hydratongs	In wood or at roadside	<85 Outside Q cab	*	1
Skyline	Excavator base	At roadside	<92 outside Q cab	1	1
	Agricultural tractor power	At roadside (in wood)	<92 outside Q cab	1	1
	Forwarder base	At roadside (in wood)	<92 outside Q cab	1	1
Stacker/loader	Agricultural tractor base	At roadside	<85 with protection of Q cab	*	1
	Front-end loader	At roadside	72–85 with protection of Q cab	*	1
	Excavator base	At roadside	75–83 with protection of Q cab	*	1
<b>Forest management</b>					
Ground preparation	Purpose-built; Forwarder base	In wood; mounding/scarifier	<80 with protection of Q cab	*	*
	Purpose-built; Skidder base	In wood; mounding/scarifier	<80 with protection of Q cab	*	*
	Excavator	In wood; mounding In wood; brush rake	75–76 with protection of Q cab	*	*
	Walking excavator	In wood; mounding In wood; brush rake	78 with protection of Q cab	*	*
Planting	Agricultural tractor base	In wood; scarifier	<80 with protection of Q cab	*	*
	Agricultural tractor base + planting machine	Tractor driver and planter	<85 tractor driver with Q cab, planter without Q cab	*	1
Drainage	Excavator	In wood	75–85 with protection of Q cab	*	1
	Crawler tractor	In wood	c. 80 with protection of Q cab	*	1
Mulchers/ 3 point linkage flail/ swath or brush-cutters, mowers	Agricultural tractor base	In wood; respacing at road/rideside; cleaning	68–90 With protection of Q cab	1	1
	Small ride-ons	General grounds maintenance	83–91	1	1

\*Hearing protection not required.

Machine type or forest operation	Basic category description	Operating position (if affecting)	Noise value indicated (dB(A))	Table number from which PPE should be selected	
				Current standard limits applicable	Future standards applicable

### Hand-held/hand-operated machinery

	Chainsaws	The recommended PPE is drawn from specific research which was undertaken to evaluate actual noise emissions for specific types of chainsaw use and exposure times. It also takes account the need to retain some hearing ability for other safety reasons	Saws less than 70 cc up to 106 Saws 70 cc or greater up to 111	1 2	1 2
	Clearing saws	Cleaning and respacing	94–104	1	1
	Strimmers	Forestry and grounds maintenance duties	94–106	1	1
	Post-hole borers	Forestry and MOT duties	<80–98	1	1
	Hedge cutters	Amenity and general groundwork	<95	1	1
	Pruning saws/shears	Forestry and amenity	c. 104	1	1
	Portable winches	Small forestry duties	<88	1	1
	Fire pumps	Several forestry and maintenance duties	80–100	1	1
	Lawn mowers	Amenity and general groundwork	82–91	1	1
	Pedestrian controlled machinery (general)	Several forestry, amenity and maintenance duties, (individual machine type assessment requirements)	82–91	1	1

### Processing machinery

Chippers – disc	Self-powered/ agricultural tractor PTO/ purpose-built	Cab operated or outside stance	92–112	2	2
Chippers – screw	Self-powered/ agricultural tractor PTO/ purpose-built	Cab operated or outside stance	92–112	2	2
Peelers and pointers	Agricultural tractor base/self-powered	One or two operators	98–101	1	1
Portable sawmills	Agricultural tractor base or self-powered	Circular mill (std), Chainsaw mill	89–101, 97–102	1, 1	1, 1

\*Hearing protection not required.

## Using Table 4: typical examples

Examples 5 and 6 below identify appropriate PPE for two particular forest operations and machine types.

### Example 5

Operation: skidding – hydratongs  
Machine used: agricultural tractor (no Q cab fitted).  
*Note: if Q cab is fitted then no PPE would be required for this operation.*

Noise level (Table 4) is up to 85 dB(A).

*Using Table 4 and current standard (85 dB(A) action level)*  
Noise level less than 85 dB(A) therefore no PPE required.

*Using Table 4 and proposed future standard (80 dB(A) action level)*  
Noise level should be reduced. Any PPE from Table 1 would meet requirements.

### Example 6

Operation: chipping  
Machine type: self-powered or agricultural tractor PTO driven or purpose built.

Noise level (Table 4) is up to 112 dB(A).  
*Note: Table 4 gives noise levels in dB(A). The use of SNR to calculate noise level at operator's ear requires knowledge of actual noise levels in dB. This would normally have to be measured unless the relationship between noise level in dB and in dB(A) was known or could be estimated.*

*Using Table 4 and current standard (85 dB(A) action level)*  
PPE from Table 2 would be required.

*Using Table 4 and proposed future standard (80 dB(A) action level)*  
The above protection would be adequate as, although the action level is 80 dB(A), steps have been taken in providing the PPE and the limit of 87 dB(A) has not been reached. If the employer or operator required the noise exposure to be reduced down to 80 dB(A) then PPE from Table 3 would be required.

## Operations with no guidance available

For some operations no noise data could be sourced and therefore an individual assessment should be made. For some of these operations, the following may aid assessment.

- **Machinery with Q cabs**

The protection afforded by the cab (provided that full protection is maintained by keeping windows and doors closed and all seals are in good order) should meet requirements without the need for additional PPE. If any ancillary equipment, powered by the base unit, is exceptionally noisy then the Q cab may not provide sufficient protection. If in doubt an individual assessment should be obtained:

- **Agricultural tractors or excavators**

For use of any operation requiring agricultural tractors or excavators, which do not have the full protection afforded by a Q cab, the noise level of the *base machine* may be above 80 dB(A). However, the PPE identified in Table 1 should provide sufficient protection against base machine noise.

## USE AND CARE OF HEARING PROTECTORS

### Earmuffs

Earmuffs should fit correctly around the ear with the seal in contact with the full circumference of the head. Thick spectacles, long hair, beards and earrings may all interfere with the seal and so reduce protection. Earmuffs must be inspected every 3 months and the inspection recorded. Between inspections users should pay due regard to the maintenance of earmuffs especially:

- The condition of the earmuff seals which may be torn or become hardened with age.
- The condition of the foam insert which may become saturated with sweat.
- General cleanliness.

### Earplugs

Earplugs can be difficult to keep clean in the forestry environments and may therefore be a potential source of ear infection. For this reason, earmuffs are the preferred

option unless there are medical or other reasons for them being unsuitable. Earplugs should be properly inserted into the ear in order to provide a good seal. Ensure that the earplugs and the hands are clean. Earplugs should never be inserted into an infected ear.

## REFERENCES AND FURTHER READING

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