Guidance on noise exposure levels

Amendment record

This Annex has been reviewed by the Directorate of Defence Safety (DDS) together with relevant subject matter experts and key safety stakeholders. Any suggestions for amendments **should** in the first instance be directed to the Defence organisation's Safety Centre/Team Group Mailbox and with their approval, sent to COO-DDS-GroupMailbox@mod.gov.uk.

Version No	Date published	Text Affected	Authority
1.2	Oct 20	Interim update post-handover of policy from DSA to D HS&EP.	D HS&EP
1.3	Sep 22	Release of two-part chapter structure.	D HS&EP
1.4	02 Apr 25	Revised to provide closer alignment with the legislation that Defence **must** comply with.	DDS

Exposure Action Values

1. The lower Exposure Action Values (EAV), upper Exposure Action Values (EAV) and Exposure Limit Values (ELV) for daily or weekly personal noise exposure and peak sound pressure are presented in the table below[1].

	lower Exposure Action Values (EAV)	upper Exposure Action Values (EAV)	Exposure Limit Values (ELV)
Daily or weekly personal noise exposure	80 dB(A-weighted)	85 dB(A-weighted)	87 dB(A-weighted)
Peak sound pressure	135 dB(C-weighted)	137 dB(C-weighted)	140 dB(C-weighted)

Table A-1 Noise exposure action and limit values

2. The daily or weekly personal noise lower EAVs, upper EAVs and ELVs presented above are time weighted average noise exposure levels. This means they are calculated from the average sound pressure level, for example 80 dB(A), and the time over which personnel are exposed to that average sound pressure level, for example 8 hours per working day.

[1] The thresholds are presented in the logarithmic decibel (dB) scale. Decibels are typically rounded to the nearest whole number or presented to no more than 1 decimal place. The levels are 'A-weighted' (dB(A)) or 'C-weighted' (dB(C)). These weightings and sound level meter specifications are outlined in **'**BS EN 61672-1:2013 Electroacoustics.

3. As per the legislation, the values presented in the table above are shown for a nominal 8 hour working day or a nominal 40 hour working week[2] [3]. This means that if an individual were exposed to an average of 80 dB(A) for 8 hours in a day, or for 40 hours in a week, then their personal exposure has reached the lower EAV. Similarly, if an individual was exposed to an average of 85 dB(A), or 87 dB(A) for those same times, their personal exposure has reached the upper EAV and ELV, respectively.

4. The peak sound pressure values refer to any maximum sound pressure received which is typically from loud, impact type noises, for example; weapons firing, explosions or percussive tools. The concept of the time weighted average noise exposure level is explained in the sections below.

5. The lower EAV refers to the lower of the two levels of daily (or weekly) personal noise exposure or of peak sound pressure which, if reached or exceeded, require specified action to be taken to reduce risk. If the lower EAV is exceeded then the commander, manager or accountable person **must**:

a. make a suitable and sufficient documented noise risk assessment to ascertain the risk to H&S from the noise. Personnel at particular risk, for example due to health reasons, **must** be considered;

b. make sure that the risk from exposure to the noise is eliminated at source. If this is deemed not reasonably practicable, the level **must** be reduced to a level that is ALARP and tolerable;

c. place individuals under a suitable audiometric health surveillance where the noise risk assessment indicates a risk to the H&S of those personnel;

d. offer personnel suitable hearing protection and ensure that those personnel are made aware of their responsibilities as custodians of such PPE; and

e. provide personnel and their representatives with suitable and sufficient information, instruction, and training.

6. The upper EAV refers to the higher of the two levels of daily (or weekly) personal noise exposure or of peak sound pressure which, if reached or exceeded, require specified action to be taken to reduce risk. These actions are in addition to the actions taken if the lower EAV is exceeded. If, after all efforts to reduce noise exposure, the upper EAV is reached or exceeded the commander, manager or accountable person **must**:

a. enforce the use of hearing protection; and

b. designate the area of high noise as a Hearing Protection Zone (HPZ).

7. The ELV refers to the level of daily, or weekly, personal noise exposure or of peak sound pressure which **must** not be exceeded.

[2] CNAWR takes into account personnel being exposed to workplace noise for 8 hours a day or for 40 hours per week. This definition has significant implications for personnel who may be in a ‘workplace’ for 24 hours per day for 7 days per week, requiring a significant reduction in the average noise level to which they can be exposed before reaching the Action Values or Limit Values.

[3] If the noise level to which an individual is exposed varies significantly over a working week, then the average over the week can be used, rather than the average over a single working day.

Average noise levels

8. Noise levels can be any combination of steady, cyclic, random, or impulsive over Time.

9. As a simple example, during an 8-hour working day, assume a steady noise level exposure to an individual of 35 dB(A) for 4 hours, 40 dB(A) for 3 hours and 85 dB(A) for the remaining 1 hour. In this example, the time-weighted average noise level is calculated by taking the (logarithmic) average of the different average noise levels over the full 8 hour working day and accounting for the time of each exposure. This indicates an average daily exposure (termed LEP,d) of approximately 76 dB(A) for the day. Whilst the last hour of the day was greater than the lower EAV and even on the threshold of the upper EAV, the overall exposure for the whole day was less than both action values.

Note: the logarithmic average differs to the linear, arithmetic average. This can be calculated using the HSE's Exposure Calculator or from the assistance of a competent person (CP).

10. This provides an example of the cumulative effect of exposure time at different average noise levels for non-expert readers. An understanding of exposure calculations is not required by the commander or manager. These calculations are best undertaken by a competent person as defined in Annex D to this chapter.

11. A relationship exists between noise level and allowable exposure time based on receiving an 'equal energy noise dose'. An increase or decrease of 3 dB(A) in (average) sound pressure level equates to a doubling or halving respectively of acoustic energy exposure in any given period of time. This means the same dose values can be achieved by trading off average noise level with total exposure time. An example of this is presented in the table below.

Average Noise Level	Time Taken to Receive upper EAV of 85
85 dB(A)	8 hours
95 dB(A)	45 minutes
100 dB(A)	15 minutes
105 dB(A)	5 minutes
110 dB(A)	Under 2 minutes
115 dB(A)	Under 30 seconds

Table A-2 Exposure times to receive upper EAV (sourced from HSG260)

12. Note that the above trade-off of average noise level and exposure time is only applicable where the peak sound pressure lower EAV, upper EAV or ELV is not being exceeded.

13. Regulation 4 of the CNAWR allows exposures to be calculated on a daily or weekly basis. Use of daily exposure is appropriate where noise exposure is similar from day to day. Weekly exposure (also known as weekly averaging) can be appropriate where noise exposure varies markedly from day to day, for example where noisy machinery is used on one day in the week but not on others. Weekly averaging is only likely to be appropriate where daily noise exposure on one or two working days in a week is at least 5 dB higher than the other days, or the working week comprises three or fewer days of exposure.

14. When considering whether to use daily or weekly averaging it is important to:

a. make sure there is no increase in risk to health. It would not, for example, be acceptable to expose personnel to very high noise levels on a single day without providing them with hearing protection. There is an overriding requirement to reduce risk to as low a level as is reasonably practicable;

b. consult the personnel concerned and their safety representatives on whether weekly averaging is appropriate;

c. explain to personnel the purpose and possible effects of weekly averaging.

Noise exposure time

15. In some instances, personnel may be exposed to noise beyond the nominal 8 hour working day or 40 hour working week in the discharge of their duties. For example, personnel on board a ship for extended periods may be exposed to noise 24 hours a day, 7 days a week. This **must** be considered during a noise risk assessment by factoring the exposure values by the appropriate time spent in different noise environments over the entirety of a 24-hour day and over a 7-day week.

16. Exposure over 24 hours, for 7 days, would equate to a reduction in the allowable average noise level by more than 6 dB(A) compared to individuals spending 40 hours per week in the workplace.

17. In other instances, the noise exposure to personnel may vary markedly from day to day. In those instances where observations over a single (nominal 8-hour) working day would be insufficient to assess noise exposure risk, observations over a (nominal 40-hour) working week **should** be used.

18. Instances where noise exposure varies markedly over time periods longer than one week **must** be identified as part of the noise risk assessment. Examples may include operational deployments, battlefield training exercises or live-fire training. In such instances, these high-noise activities **must** all be assessed for risk from noise. Whilst averaging noise exposure over a working week is allowed in the legislation, averaging over longer time periods is not, and therefore the impact of infrequent high-noise activities **must** be assessed, and risk managed individually. The HSE's noise exposure calculator and ready-reckoner is the preferred method to estimate daily or weekly noise exposure. If connectivity is an issue, the MOD noise exposure ready reckoner in Table A-3 can be used when use of the HSE online version is not possible.

Sound pressure level, L_{Aeq} (dB(A))	Duration of exposure							
	15 min	30 min	1 hr	2 hr	4 hr	8 hr	10 hr	12 hr
104	250	500	1000	2000	4000	8000		
103	200	400	800	1600	3200	6500	8000	
102	160	320	650	1250	2500	5000	6500	7500
101	125	250	500	1000	2000	4000	5000	6000
100	100	200	400	800	1600	3200	4000	4700
99	80	160	320	650	1250	2500	3200	3800
98	65	125	250	500	1000	2000	2500	3000
97	50	100	200	400	800	1600	2000	2400
96	40	80	160	320	650	1300	1600	1900
95	32	65	125	250	500	1000	1300	1500
94	25	50	100	200	400	800	1000	1200
93	20	40	80	160	320	650	800	950
92	16	32	65	125	250	500	650	750
91	13	25	50	100	200	400	500	600
90	10	20	40	80	160	320	400	470
89	8	16	32	65	130	250	320	380
88	6	12	25	50	100	200	250	300
87	5	10	20	40	80	160	200	240
86	4	8	16	32	65	125	160	190
85	3	6	13	25	50	100	125	150
84		5	10	20	40	80	100	120
83		4	8	16	32	65	80	95
82			6	13	25	50	65	75
81			5	10	20	40	50	60
80			4	8	16	32	40	48
79				6	13	25	32	38
78				5	10	20	25	30
77				4	8	16	20	24

Total exposure points (sum of points from individual exposure	Daily noise exposure $L_{EP,d}$ (dB(A))
8000	104
6500	103
5000	102
4000	101
3200	100
2500	99
2000	98
1600	97
1300	96
1000	95
800	94
650	93
500	92
400	91
320	90
250	89
200	88
160	87
125	86
100	85
80	84
65	83
50	82
40	81
32	80
25	79
20	78
16	77

Table A-3 - MOD noise exposure ready reckoner (sourced from Institute of Naval Medicine).

	Above upper exposure action value (L EP,d 85 dB(A))
	Above lower exposure action value (L EP,d 80 dB(A))
	Below lower exposure action value (L EP,d 80 dB(A))

Table A-3 Instructions:

a. For each task or period of noise exposure in the working day look up in the table on the left the exposure points corresponding to the sound pressure level and duration (e.g. exposure to 93 dB for 1 hour gives 80 exposure points);

b. Add up the points for each task or period to give total exposure points for the day;

c. Look up in the table on the right the total exposure points to find the corresponding daily noise exposure (e.g. a total exposure points for the day of 280 points gives a daily noise exposure of between 89 and 90 dB).