

26 Vibration at work

This chapter is split into two parts:

Part 1: Directive. This part provides the direction that you **must** follow and to help you comply with (keep to) health and safety law, Defence policy and Government policy.

Part 2: Guidance. This part provides the guidance and good practice that **should** be followed and will help you to keep to this policy.

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Amendment record

This chapter has been reviewed by the Directorate of Defence (DDS) together with relevant subject matter experts and key safety stakeholders. Any suggestions for amendments **should** be 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	Nov 22	Release of two-part chapter structure.	D HS&EP
1.4	20 June 23	Inclusion of further clarity on HAV Health Surveillance and WBV Health Monitoring.	DDS

Terms and definitions

The following table sets out definitions of some of the key terms used in this chapter. The general safety terms and definitions are provided in the [Master Glossary of Safety Terms and Definitions](#) which can also be accessed via the [GOV.UK](#) page.

Accountable person	The person whose terms of reference state that they are responsible for making sure there are suitable and sufficient systems in place to control health, safety and environmental protection risks in their establishment, unit, or platform. The term 'accountable person' is used in place of CO, HoE, OC, Station Commander and so on, which are sometimes used by Defence organisations.
Commander	A military person responsible for planning activities, supervising activities, and making sure that personnel under their area of responsibility are safe. This term refers to a role rather than the rank of Commander, and it can be a permanent or temporary role (for example; for the duration of a training exercise). In parts of Defence this person could be referred to as a 'responsible person'.
Competent person	A person who has the training, skills, experience, and knowledge necessary to perform a task safely, and is able to apply them. Other factors, such as attitude and physical ability, can also affect someone's competence. (See www.hse.gov.uk/competence/what-is-competence.htm for information on competence).
Exposure	Refers to a period of time, for example hourly, daily, or weekly, that personnel are exposed to the vibration environment. The term 'vibration exposure' is the combination of a time period and the average amplitude of the vibration over that time period

Exposure action value (EAV)	Refers to a daily or weekly average vibration level threshold which represents a clear risk, requiring management The Legislation defines one EAV for each of Hand-Arm Vibration (HAV) and Whole Body Vibration (WBV).
Exposure limit value (ELV)	Refers to the level of daily or weekly personal vibration exposure which must not be exceeded
Manager	A person responsible for managing or supervising staff, planning activities, and making sure that personnel under their area of responsibility are safe. This could be a permanent or temporary role, and in parts of Defence this person could be referred to as a 'line manager', a 'responsible person' or a 'delivery manager'.
Residual risk	The level of risk remaining after control measures have been applied.
Risk assessment	A systematic process of identifying hazards and evaluating any risks associated with those hazards.
Safety Case	A structured argument, supported by a body of evidence that provides a compelling, comprehensible, and valid case that a system is safe for a given application in a given operating environment..
Vibration	The mechanical oscillations of an object about an equilibrium point.
Vibration risk assessment	Refers to a documented process for measuring (estimating) the magnitude of the risk as part of mitigating it to ALARP and informing any decision on whether or not that risk is tolerable.

Must and should

Where this chapter says '**must**', this means that the action is a compulsory requirement.

Where this chapter says '**should**', this means that the action is not a compulsory requirement but is a recommendation of good practice to comply with the policy.

Scope

This policy applies to all those employed by Defence (military or civilian) as well as those working on behalf of Defence (for example, contractors). It applies to all Defence activities carried out in any location (UK or overseas).

Part 1 Directive

Introduction

1. This Defence policy **must** be followed to manage:
 - a. Vibration at work risks to Defence personnel and those affected by Defence activities; and
 - b. The measures to be taken to eliminate those risks or reduce them to as low as is reasonably practicable (ALARP) and tolerable, in order to minimise harm and comply with current UK H&S legislation.
2. Vibration is encountered almost everywhere in daily life for example whilst driving on roads, travelling by train, on a ship or when riding in a lift. Exposure to vibration from these sources will not typically cause harm. However, some sources of vibration do have the potential to cause adverse health effects. Health may be impacted by immediate and / or prolonged exposure
3. The Legislation outlines two specific categories of occupational vibration exposure;
 - a. Hand Arm Vibration (HAV). This is exposure to vibration from mainly hand-held, hand-guided and / or hand-fed tools. This includes the vibrations from the various controls and handles of, for example, Armoured Fighting Vehicles (AFVs); and
 - b. Whole Body Vibration (WBV). This is exposure to vibration usually transmitted to the whole body from a supporting surface, seat, or a platform, for example part of a vehicle, ship, boat, or aircraft.
4. The risk of vibration induced injury is directly related to exposure time, intensity, and repetition of exposure to that vibration. This includes intermittent exposure and repeated shocks¹. The combination of the magnitude of the vibration and the exposure time to that vibration together defines 'vibration exposure' that is discussed in this chapter.
5. Hand Arm Vibration Syndrome (HAVS) is a syndrome which collectively describes conditions which affect the nerves, blood vessels, muscle and joints of the hand, wrist, and arm. HAVS is a result of vibration causing damage to these areas and can become severely disabling if ignored. Conditions include:
 - a. Vibration White Finger (VWF), a vascular condition affecting blood vessels in the extremities, for example the fingers and thumbs; and
 - b. Carpal Tunnel Syndrome (CTS), a nerve disorder resulting in pain, tingling and weakness in parts of the hand.

¹ Defined as a sudden impact that transmits energy to a person in a relatively short time interval, for example, an all-terrain vehicle crossing rough terrain, or a small, fast boat impacting waves.

Legislation

6. UK Health and Safety (H&S) legislation requires employers to protect, so far as is reasonably practicable (SFAIRP), the health, safety and welfare of employees and anyone else who may be affected by a work activity. In line with the Secretary of State's (SofS) for Defence HS&EP Policy Statement these requirements are to be put in place and complied with for all Defence activities, including where legal exemptions exist in the UK and overseas.
7. Defence more commonly uses the term as low as reasonably practicable (ALARP). The Health and Safety Executive (HSE) consider that the two phrases (SFAIRP and ALARP) essentially mean the same thing. This Defence policy **must** be followed to manage:
 1. the H&S risks to Defence personnel and those affected by Defence activities; and
 2. the measures to be taken to eliminate those risks or reduce them to as low as reasonably practicable (ALARP) and tolerable, in order to minimise harm and comply with current UK H&S legislation.
8. The key legislation (herein referred to as 'Legislation') that applies to the management of vibration at work are:
 - a. [The Control of Vibration at Work Regulations 2005 \(CVAWR\)](#);
 - b. [The Control of Vibration at Work \(Northern Ireland\) Regulations 2005 \(CVAW\(NI\)R\)](#);
 - c. [The Merchant Shipping and Fishing Vessels \(Control of Vibration at Work\) Regulations 2007](#);
 - d. [The Health and Safety at Work etc Act 1974](#);
 - e. [The Health and Safety at Work etc. Act 1974 \(Application outside Great Britain\) Order 2013](#);
 - f. [The Health and Safety \(Safety Signs and Signals\) Regulations 1996](#);
 - g. [The Provision and Use of Work Equipment Regulations 1999 \(PUWER\)](#);
 - h. [Schedule 1 to The Management of Health and Safety at Work Regulations 1999](#),
 - i. [The Supply of Machinery \(Safety\) Regulations 2008](#); and
 - j. [The Personal Protective Equipment at Work Regulations 1992](#);

Note: Legislation may change, therefore always make sure that the version of the legislation that you are looking for is the current one.

9. Supplementing the legislation are two Approved Codes Of Practice (ACOP) from the HSE, these are [Hand-arm vibration L140](#) and [Whole-body vibration L141](#).

10. The CVAWR **must** apply to and in relation to any Defence activity outside GB where sections 1 to 59 and 80 to 82 of the Health and Safety at Work etc. Act 1974 (Application Outside Great Britain) Order 2001 apply.

11. The HSE regulates only in GB, not the entire United Kingdom. In Northern Ireland workplace H&S is regulated by HSENI (www.hseni.gov.uk).

12. This legislation provides statutory limits to vibration exposure in the workplace with a view to protecting personnel against risk to their H&S.

Defence exemption

13. Where the interests of National Security conflict with key aspects of the legislation the SofS for Defence may grant an exemption (where explicitly stated within the legislation) to the provisions of the whole or specific parts of that legislation (CVAWR) for any person or class of persons, by a certificate in writing.

14. A commander, manager or accountable person **must** exhaust alternative options that would reasonably both control the risk due to the vibration exposure, and protect the interests of national security, before seeking such an exemption certificate. The exemption certificate process is explained in more detail at Annex G to this chapter.

Vibration at work policy statements

15. The following vibration at work policy statements have been established and **must** be followed. All vibration risk assessments **must** be carried out in line with the five-step risk assessment process using the methodology set out in Chapter 8 of JSP 375 Volume 1 and set out in policy statements 1 to 7 below.

Note: Vibration exposure terminology is set out in the 'terms and definitions' table above and details of the 'exposure action and limit values' are set out in Annex A to this chapter.

a. **Policy Statement 1 (Step 1 - Identifying the vibration hazard).**

The commander, manager or accountable person **must** identify the activities that may put personnel at risk from exposure to harmful vibration levels in the workplace. Where this is the case the commander, manager or accountable person **must** make sure that the risk is either eliminated or reduced to a level that is as low as reasonably practicable (ALARP) and tolerable.

b. **Policy Statement 2 (Step 2 - Decide who may be harmed by the Vibration hazard).**

The commander, manager or accountable person **must** identify who may be at risk from exposure to harmful vibration levels or where people are exposed to vibration levels above the relevant Exposure Action Value (EAV).

c. **Policy Statement 3 (Step 3 - Evaluate the vibration risk and identify sufficient control measures).**

The commander, manager or accountable person **must** make sure that suitable and sufficient vibration risk assessments are carried out for activities where it could reasonably be expected that personnel are at risk from exposure to harmful vibration levels created by those activities, to identify suitable and sufficient control measures.

Where an Exposure Limit Value (ELV) has been exceeded the commander, manager or accountable person **must**;

- (1) reduce the exposure levels to below the ELV;

- (2) identify the reasons why the ELV was exceeded and decide what actions are necessary; and
- (3) make such changes to prevent the ELV being exceeded again.

d. **Policy Statement 4 (Step 4 - Record your findings and implement them).**

The commander, manager or accountable person **must** record the findings of the vibration risk assessment and communicate them, along with details of the associated control measures, to those people who may be exposed to harmful vibration levels.

e. **Policy Statement 5 (Step 5 - Review the vibration risk assessment and update if necessary).**

The commander, manager or accountable person **must** make sure that all vibration risk assessments are regularly reviewed and further control measures put in place if there are any changes to the activity or where the risk of exposure to harmful vibration levels increases.

f. **Policy Statement 6 - Specifying and procuring equipment with consideration to vibration.**

Defence acquisition organisations who are responsible for the design, procurement and support of equipment **must**:

- (1) make sure that, vibration hazards are considered as part of the procurement process; and
- (2) make sure that, where vibration hazards have been identified relevant vibration hazard information is passed on to the equipment users.

g. **Policy Statement 7 - Consideration of personnel particularly at risk.**

Personnel **must** inform the commander, manager or accountable person of any physical or medical condition where their health is likely to be particularly at risk from exposure to vibration. The commander, manager or accountable person **must** get medical advice relating to those considered at particular risk, **must** put in place the necessary control measures, and **must** make sure that those personnel are placed under suitable vibration health surveillance.

Policy Statement 1 (Step 1 - Identifying the vibration hazards).

The commander, manager or accountable person **must** identify the hazards associated with the activities that may put personnel at risk from exposure to harmful vibration levels in the workplace. Where this is the case the commander, manager or accountable person **must** make sure that the risk is either eliminated or reduced to a level that is as low as reasonably practicable (ALARP) and tolerable.

16. The commander, manager or accountable person who has control of the workplace, is responsible for planning an activity, or has control of those taking part in an activity, **must** make sure that all reasonably foreseeable hazards associated with activities they have responsibility for are identified (for example exposure to harmful vibration levels). They may delegate the responsibility (but not the accountability) for identifying reasonably foreseeable hazards to a competent person but **must** make sure that the competent person has met that responsibility.

17. The person carrying out the hazard identification **should** have a good understanding of the activity, or process that is being assessed and **should** carry out this hazard identification in consultation with the personnel taking part in the activity.

18. Note that vibration exposure levels can be below the Exposure Action Values (EAV) and still pose a risk. Specifically, where the vibration exposure levels are likely to reach or exceed Exposure Action Value (EAV) then the same underlying principle applies: to reduce exposure to ALARP and tolerable. This would include a programme of organisational and technical measures.

19. The actions to be taken **must** be based on the general principles of prevention set out in Schedule 1 to The Management of Health and Safety at Work Regulations 1999, incorporating consideration of the relevant factors defined in the Legislation. The principles include:

- a. avoiding risks;
- b. evaluating the risks which cannot be avoided;
- c. combating the risks at source;
- d. adapting the work to the individual, especially with regards to the design of workplaces, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health;
- e. adapting to technical progress;
- f. replacing the hazardous with the non-hazardous or the less hazardous;
- g. developing a coherent overall prevention policy which covers technology, organisation of work, working conditions, social relationships and the influence of factors relating to the working environment;
- h. giving collective protective measures priority over individual protective measures; and
- i. giving appropriate instructions to employees.

Policy Statement 2 (Step 2 - Decide who may be harmed by the Vibration hazard).

The commander, manager or accountable person **must** identify who may be at risk from exposure to harmful vibration levels or where people are exposed to vibration levels above the relevant Exposure Action Value (EAV).

20. The commander, manager or accountable person **must** identify who might be at risk from exposure to harmful vibration levels associated with the activity, and at the earliest opportunity provide those personnel with suitable and sufficient information and instruction.

21. It is recognised that the vibration exposure to personnel during military activities may be substantially different and more difficult to manage compared to the vibration exposure of civilians undertaking non-military activities. It is further recognised that national security may require exceptional cases to be made. This is addressed in more detail in the Defence exemption section of this chapter.

22. The commander, manager or accountable person **must** assess the levels of vibration to which personnel are exposed, in line with the vibration exposure levels in the Legislation. These are reproduced in Figure 2-1 in Part 2 of this chapter.

Policy Statement 3 (Step 3 - Evaluate the vibration risk and identify sufficient control measures).

The commander, manager or accountable person **must** make sure that suitable and sufficient vibration risk assessments are carried out for activities where it could reasonably be expected that personnel are at risk from exposure to harmful vibration levels created by those activities, to identify suitable and sufficient control measures.

Where an Exposure Limit Value (ELV) has been exceeded the commander, manager or accountable person **must**;

- (1) reduce the exposure levels to below the ELV;
- (2) identify the reasons why the ELV was exceeded and decide what actions are necessary; and
- (3) make such changes to prevent it being exceeded again.

23. The commander, manager or accountable person **must** make sure that suitable and sufficient vibration risk assessments are carried out, they may delegate this responsibility to a competent person. The risk assessor may seek advice from SME's where appropriate. Vibration assessment competency is set out in Annex D to this chapter.

24. A vibration risk assessment is considered suitable and sufficient if it includes:

- a. an identification of where the risk of HAV or WBV may be present for a work activity;
- b. an estimate of the representative vibration exposure to personnel with a comparison to the EAVs and the ELVs;
- c. the risk controls available and those implemented to reduce exposure;
- d. an identification of individuals who may be at particular risk of vibration induced harm;
- e. an identification of other factors that may exacerbate the impact of vibration exposure, for example low temperatures, wind chill; and
- f. provisions already taken and planned to monitor and control the risks of HAV or WBV injury.

25. Assessment of vibration exposure **should** ideally be based on measured values (as set out in Annex A to this chapter) and evaluated using the Hand Arm Vibration ready reckoner (as set out in Annex F to this chapter) or, where this is not available; manufacturer's values can be used.

26. This requirement applies to personnel responsible for equipment procurement programmes and maintenance / update programmes, as much as those managing operational sites, equipment, and activities. This includes training and operations.

27. Equipment procurement or modification activities **must** include appropriate assessments of the likely vibration exposure arising from use of the equipment to the end user and other personnel, and any other risks associated with that vibration exposure.
28. The vibration exposure assessment **must** take account of vibration experienced during off-duty personnel where those personnel are in a Defence facility or platform when off duty, for example onboard a ship.
29. Where a vibration risk assessment is carried out, the following hierarchy of control measures (the measures to control risk), the order **must** be followed for example; always try to eliminate the hazard first and do not simply jump to the easiest control. The order of the hierarchy of control is as follows;
1. **Elimination.** Redesign the job or use a different process, or piece of equipment and so on so that the hazard is removed or eliminated.
 2. **Substitution.** Replace the process, or equipment with a less hazardous one.
 3. **Engineering controls.** Engineer the equipment to protect the operator (for example carry out servicing and maintenance of the equipment).
 4. **Administrative controls.** These are all about identifying and implementing the procedures that need to be followed to work safely (for example, rotating tasks to reduce the time workers are exposed to hazards, putting up safety signs, and carrying out risk assessments and so on).
 5. **Personal Protective Equipment (PPE).** In the standard hierarchy of controls if all the previous measures have been evaluated and found to be ineffective or not able to reduce risks to ALARP and tolerable, personal protective equipment (PPE) **must** be used. However, for vibration hazards there is little evidence as to the effectiveness of anti-vibration PPE currently available, therefore specialist advice **should** be sought when assessing what PPE is required for a work activity.
30. The commander, manager or accountable person **must** consider applying the hierarchy of controls singularly or collectively for example; engineering and procedural control measures may both be implemented to reduce vibration exposure to levels that are ALARP and tolerable. All control measures implemented, **must** be correctly used, or followed by personnel and those personnel **must** be appropriately trained where required. Consideration **must** be given to the effects or new hazards that may be introduced as a result of implementing any of the controls.
31. The control measures for example; could include appropriate servicing schedules to make sure that vibration levels are checked and that maintenance is carried out and the correct application or use of vibration control and reduction measures and training in their use.

32. Work activities at colder temperatures and / or wet environments present additional risk of damage during exposure to vibration. This is due to the compounding effect between the temperature affecting the blood vessels of the extremities and the vibration exposure. The provision of warm clothing and gloves are considered to be PPE, purely in the context of offering protection from environmental conditions and will aid vascular circulation to help mitigate this effect. The clothing **should** be assessed for good fit and its effectiveness in keeping personnel warm and dry.

33. Vibration mitigation equipment provided or specified, **must** be compatible with the intended use case and with other equipment that is to be used and **must** be assessed for the effectiveness of its intended use by a suitably qualified specialist. For example, gloves **should** be durable and suitable for the anticipated environmental conditions and allow effective operation of equipment.

34. It is an additional requirement that all personnel are individually responsible for reporting defects and for appropriately using any or all vibration exposure reduction measures provided, in accordance with this policy. The commander, manager or accountable person **must** make sure that all such personnel are aware of their obligations and that they comply with these obligations.

Policy Statement 4 (Step 4 - Record your findings and implement them).

The commander, manager or accountable person **must** record the findings of the vibration risk assessment and communicate them, along with details of the associated control measures, to those people who may be exposed to harmful vibration levels.

35. The commander, manager or accountable person **must** make sure that the control measures and the findings from the risk assessment are recorded, to enable the evaluation of exposure levels and demonstration of compliance with the legislation and so that informed decisions can be made about incorporating further control measures if necessary.

36. The commander, manager or accountable person **must** make sure that suitable and sufficient training is provided to all personnel where necessary to ensure the effective implementation of the vibration control measures.

37. Recording of the risk assessment can also identify where good practice has resulted in a better outcome than would otherwise have been expected and may identify opportunities to share good practice wider in order to improve organisational performance.

38. Where a vibration risk assessment is required, the commander, manager or accountable person **must**:

- a. record the significant findings of the vibration risk assessment as soon as is reasonably practicable after the vibration risk assessment has been created or is changed;
- b. record the control measures which have been taken and which are intended to be taken to meet the requirements of this Policy; and

c. review control measures and improve them if reasonably practicable to do so, whilst also considering alternative ways of working. Consider informing command chains of any changes and requesting additional resource / levers / authority to apply additional controls that may reduce the residual risk further.

39. The commander, manager or accountable person **must** communicate findings from the risk assessment, along with details of the associated control measures, to those people who may be exposed to harmful vibration levels.

40. Suitable control measures **should** be developed in consultation with the Defence personnel concerned and where appropriate Trade Unions and / or employee safety representatives.

41. The consultation **must** cover:

- a. the findings of the vibration risk assessment;
- b. measures taken to eliminate or control exposure to vibration; and

42. Consultation is also an effective tool to promote a safety culture which is cost-effective in the management of the risks associated with vibration exposure and to obtain the understanding and 'buy-in' required from all personnel.

43. Note that where risks are identified and / or improvements or other actions are defined as a part of the vibration risk assessment, it is imperative to define an immediate action plan to implement actions and to review the results. It is not acceptable to leave such actions unaddressed until subsequent periodic assessments or audits.

44. Where personnel are exposed to vibration which is likely to be at or above the Exposure Action Value, the commander, manager or accountable person **must** provide those personnel with suitable and sufficient information, instruction, and training.

45. Appropriate information, instruction and training is essential to enable personnel to fulfil their own obligations under the legislation (see link at paragraph 8 c) to protect both their own H&S as well as that of others. Appropriate information, instruction and training can include:

- a. information explaining the risks to the H&S of personnel from exposure to vibration;
- b. information explaining the obligations of everyone involved in protecting their own H&S and that of those around them;
- c. instruction and training on the proper use of equipment that creates vibration and equipment that protects personnel from vibration. For example, this instruction and training can cover the necessary checks to confirm the equipment is working properly and is not making undue levels of vibration, maintenance required to keep the equipment in such good working order and training on how to best use the equipment provided in a way that reduces the risks to H&S from vibration to a level that is ALARP; and

46. The information, instruction and training **must** be updated to consider significant changes in the type of work carried out or working methods used by the personnel.

Policy Statement 5 (Step 5 - Review the vibration risk assessment and update if necessary).

The commander, manager or accountable person **must** make sure that all vibration risk assessments are regularly reviewed and further control measures put in place if there are any changes to the activity or where the risk of exposure to harmful vibration levels increases.

47. The commander, manager or accountable person is responsible for reviewing the vibration risk assessment and for reviewing the effectiveness of the control measures that have been put in place and along with the competent person (if it is not them) to identify any further control measures that may be required as a result of the review, for example signage to show information on the signs and symptoms of vibration injury.

48. The commander, manager or accountable person **must** carry out an initial review of the vibration risk assessment. This review **should** take place no longer than 3 months after the detailed vibration risk assessment was carried out. There **must** be periodic reviews thereafter at a frequency based on the change of risk but normally not exceeding every two years. Additionally, the control measures **must** also be reviewed if there are any changes to the work activity or to the control measures that have been put in place. For example:

- a. new vibration emitting equipment has been introduced;
- b. there are reports of vibration exposure;
- c. after an accident or near-miss where vibration could have been a contributory factor to the accident;
- d. a change in the environment (wet, temperature etc)
- e. a change in location (layout, addition or removal of physical factors such as structures, ground works etc) or duration of exposure; and
- f. if there is any reason to suspect that current detailed vibration risk assessment is no longer valid.

49. If any review indicates that a vibration exposure issue remains which is impacting those taking part in the activity, other workers, visitors, or members of the public, then the commander, manager or accountable person **must** re-assess the risk and then consider the following actions.

- a. Pausing or stopping the activity.
- b. Adding further control measures.
- c. Elevating the risk.

Policy Statement 6 - Specifying and procuring equipment with consideration to vibration. Defence acquisition organisations who are responsible for the design, procurement and support of equipment **must**:

- (1) make sure that, vibration hazards are considered as part of the procurement process; and
- (2) make sure that, where vibration hazards have been identified relevant vibration hazard information is passed on to the equipment users.

50. Defence acquisition organisations **must** make sure that vibration modelling, testing and specification level limits to identify vibration hazards are considered as part of the procurement process for equipment. Where vibration hazards are identified as part of the concept, assessment, or design phases of the CADMID cycle, or other procurement methods for example; commercial off the shelf (COTS), Defence acquisition organisations **must** make sure that these hazards are mitigated so far as is reasonably practicable before the equipment enters service and detailed in the equipment Safety Case.

51. It is essential that vibration mitigation engineering is considered at the earliest stage of the procurement process where high vibration or shock levels might reasonably be expected in order to protect personnel from the risk of exposure to harmful vibration levels. Severe vibration can prevent equipment being accepted into service, as not fit for purpose, with significant financial and military capability impacts, it can also lead to premature equipment failure if it enters service with vibration issues.

52. It is not always possible to completely mitigate vibration hazards before the equipment enters service, in these circumstances Defence acquisition organisations **must** provide the relevant vibration hazard information (for example vibration data) to the equipment users prior to its acceptance into service.

Policy Statement 7 - Consideration of personnel particularly at risk.

Personnel **must** inform the commander, manager, or accountable person of any physical or medical condition where their health is likely to be particularly at risk from exposure to vibration. The commander, manager or accountable person **must** get medical advice relating to those considered at particular risk, **must** put in place the necessary control measures, and **must** make sure that those personnel are placed under suitable vibration health surveillance.

53. Personnel **must** inform the commander, manager, or accountable person of any physical or medical condition where their health is likely to be particularly at risk from exposure to vibration. People vary in their susceptibility to vibration exposure. Likewise, anyone who has already suffered HAVS or WBV injury may be more susceptible to further damage. Pregnant women and people with medical implants or who have had recent surgery may be particularly at risk. A risk assessment **must** be carried out where this area of elevated exposure is apparent. More stringent additional control measures may be required for such personnel.

54. Where the vibration risk assessment determines that Defence personnel are likely to be exposed to HAV, those personnel **must** conduct a pre-exposure self-assessment using MOD Form 5053². The pre-exposure self-assessments are used to identify those particularly at risk from the exposure to vibration and to determine the level of impact this may have on their health. Where the pre-exposure self-assessment has identified that personnel are at risk of HAV, in accordance with the legislation [Hand-arm vibration Guidance on Regulations L140 \(Reg 7 - para 37\)](#), they **must** be placed on a suitable [health surveillance](#) programme, which is set out in Chapter 14 of JSP 375 Volume 1.

55. Where the vibration risk assessment determines that Defence personnel are likely to be exposed to WBV, those personnel **should** conduct a pre-exposure self-assessment using MOD Form 5055³. The [Whole-body vibration Guidance on Regulations L141 \(Reg 7\)](#), states that health surveillance is not appropriate for WBV, and therefore recommends a less precise measure than the formal health surveillance approach, such as reporting and monitoring of symptoms, which is generally referred to as 'health monitoring'. Therefore, those personnel with significant risk of WBV **should** be placed under suitable health monitoring, which is set out in Chapter 14 of JSP 375 Volume 1.

56. The commander, manager or accountable person **must** get medical advice relating to those considered at risk and put in place the necessary control measures. Personnel have a responsibility to inform the commander, manager or accountable person where the control measures that have been put in place to reduce their exposure levels are ineffective.

57. The management of vibration health surveillance and monitoring is presented in Annex E.

Vibration health surveillance of personnel at risk and medical intervention.

58. If a vibration risk assessment indicates a health risk to personnel, the commander, manager or accountable person **must**:

- a. pause or stop work in that activity area and conduct a review of the control measures in place and update / improve those controls, as necessary.
- b. make sure those personnel are placed under suitable vibration health surveillance;
- c. keep available, and maintain in a suitable form, the health records of personnel who undergo health surveillance;
- d. on reasonable notice being given, allow personnel access to their personal health record and provide copies to the enforcing authority such as it may require; and
- e. refer to a doctor or appropriate medical specialist, those personnel who are suspected of suffering from vibration health effects, for example as identified by vibration health surveillance.

² If already exposed to HAV then the annual questionnaire section of MOD Form 5053 must be used.

³ If already exposed to WBV then MOD Form 5056 should be used instead of MOD Form 5055.

59. Where personnel have been referred to a doctor or an appropriate medical specialist who considers that those personnel are suffering from vibration health effects as a result of exposure to vibration, the commander, manager or responsible person **must**:

- a. make sure that a suitably qualified person informs the personnel;
- b. review the vibration risk assessment;
- c. review any vibration exposure control measures;
- d. make sure they are informed of any significant findings from the health surveillance of the individual, taking into account any medical confidentiality;
- e. consider any advice given by a doctor or occupational health professional or enforcing authority;
- f. consider assigning personnel to alternative work where there is no risk from further exposure to vibration; and
- g. continue health surveillance and provide for a review of the health of any other employee who has been similarly exposed.

60. All personnel so affected and requested by the commander, manager or accountable person, **must** attend such health surveillance as deemed appropriate by the doctor or referring specialist.

61. The commander, manager or accountable person **must** make sure that personnel who are subject to vibration health surveillance are assessed at least annually, or as directed by Occupational Health or Service Health units, to check for any vibration induced symptoms.

62. The commander, manager or accountable person **must** provide suitable advice and support to the affected person and make sure that they attend health surveillance as required. Further guidance on the management of vibration health surveillance is set out in Annex E to this chapter.

Part 2 Guidance

This part provides guidance and best practice methods that **should** be followed. Following this guidance will aid commanders, managers or accountable persons to keep to the mandated requirements of the Legislation.

Measures of vibration exposure and threshold values

1. Vibration exposure is calculated from a form of time-average vibration (acceleration) level and the time that a person is exposed to that average vibration level. The concept of the time-average vibration exposure level is explained in Annex A.
2. Vibration acceleration levels are measured in metres per second, per second and are denoted by the abbreviation 'ms⁻²' which follows the numbers that give the level of the vibration level, for example '1.2 ms⁻²'.
3. Vibration of a defined level, for example 1.2 ms⁻², but at different frequencies will have different effects when experienced by people. This includes both how harsh that vibration appears to be and also the damage it can cause to various parts of the body. Different 'frequency weightings' are applied to correct for these effects. There are different weightings that are applied if vibration is input to different parts of the body (hand, back, feet and so on), and for vibration in different directions (aligned with the spine, side to side and so on). The definition of these different frequency weightings is complex and understanding them is not necessary except for those competent persons undertaking detailed assessments.
4. The vibration exposure for an individual, calculated or measured over a working day and normalised to the nominal 8 hours, is termed the "A(8)" vibration exposure. This is sometimes referred to as the daily vibration exposure.
5. There are thresholds of vibration exposure, above which key obligations or actions become necessary. These thresholds for the Exposure Action Values (EAV) and the Exposure Limit Values (ELV) for both HAV and WBV are presented in Table 2-1.

	Exposure Action Value (EAV)	Exposure Limit Value (ELV)
Hand-Arm Vibration (HAV)	2.5 ms ⁻² A(8)	5 ms ⁻² A(8)
Whole Body Vibration (WBV)	0.5 ms ⁻² A(8)	1.15 ms ⁻² A(8)

Table 2-1 Daily vibration exposure action and limit values for HAV and WBV

6. As per the Legislation, the values presented in Table 2-1 are shown for a nominal 8 hour working day or a nominal 40 hour working week (covered more in the following paragraphs). This means that, for example, if an individual were exposed to an average vibration of 2.5 ms⁻² A(8) when operating hand tools, or 0.5 ms⁻² A(8) when standing on a vibrating platform, for 8 hours in a day, or for 40 hours in a week, then their personal exposure has reached the EAV.

7. Likewise, if an individual was exposed to an average of $5 \text{ ms}^{-2} A(8)$ when operating hand tools, or $1.15 \text{ ms}^{-2} A(8)$ when on a vibrating platform for those same times, their personal exposure has reached the ELV.
8. The EAV refers to the amount of personal vibration exposure which, if reached or exceeded, requires a specified action to be taken to reduce the risk of exposure. If the EAV is exceeded then the commander, manager or accountable person is to:
- make a suitable and sufficient documented vibration risk assessment to ascertain the risk to H&S of personnel from the vibration. Personnel at particular risk, for example due to health reasons, are to be considered;
 - make sure that the risk from exposure to the vibration is eliminated at source. If this is considered as not being reasonably practicable, the level is to be reduced to a level ALARP and tolerable;
 - place individuals under suitable vibration health surveillance where the vibration risk assessment indicates a risk to the H&S of those personnel; and
 - provide personnel and their representatives with suitable and sufficient information, instruction, and training.
9. The ELV refers to the level of personal vibration exposure which is not to be exceeded.
10. In some instances, personnel may be exposed to vibration 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 vibration 24 hours a day, 7 days a week. This is to be considered during a vibration risk assessment by factoring (or normalising) the exposure values by the appropriate time spent in different vibration environments over the entirety of a 24-hour day and / or over a 7-day week.
11. In some instances, the vibration exposure levels to personnel may vary considerably daily (for example personnel working with or exposed to vibration from different sources). In these instances where exposure periods vary over a single working day it would be difficult to assess the precise vibration exposure levels, and therefore a (nominal 40 hour) working week **should** be used.
12. Instances where vibration exposure varies considerably over time periods longer than one week are to be identified as part of the detailed vibration risk assessment. Examples may include operational deployments, battlefield training exercises and so on. In addition to identifying the occurrence of such instances in the risk assessment, these high-vibration activities are to all be individually quantitatively assessed for risk from vibration. Whilst averaging vibration exposure over a working week is allowed in the Legislation, averaging over longer time periods is not, and therefore the impact of infrequent high-vibration activities are to be assessed and risk managed individually.

Roles and responsibilities

Defence organisations

13. This section sets out the responsibilities for key roles in Defence organisations. It is clear that there is no singular set of boundaries for responsibility that can be succinctly defined that will apply for any situation that can be found within Defence organisations. It is therefore necessary for the Accountable Person to make sure that the roles and responsibilities outlined here are addressed by people suitably identified within their organisation.

14. Defence organisations are to make sure that sufficient resources are made available to comply with the Legislation by those responsible for implementing the requirements of the Legislation. Defence organisations can help those responsible for discharging their duties in accordance with the Legislation by:

- a. planning and providing sufficient budgets to support essential tasking and activities;
- b. promoting and sustaining a culture of vibration exposure control by ensuring the effective implementation of control measures at all levels throughout the organisation;
- c. providing or ensuring access to competent advice;
- d. providing Personnel with sufficient instruction and training;
- e. commissioning vibration risk assessments;
- f. commissioning vibration health surveillances; and
- g. providing sufficient information to Defence personnel to ensure they understand Defence obligations under the Legislation, and their own role in complying with these.

15. Legacy equipment (outdated, obsolete, or no longer in production) that remain in current use and vibrate are the responsibility of the Defence organisation's senior leader if, the equipment had been purchased before the implementation of purchasing systems with a through-life asset management capability (within which asset management roles and responsibilities are defined).

16. The Defence organisation **should** make sure that all legacy equipment is identified, and resources and procedures are in place for its maintenance. In line with the Legislation, this **should** be with a view to eliminating or reducing vibration exposure to the user to a level that is ALARP when operated or where personnel are in proximity of the equipment. This is to minimise the risk of vibration induced damage, and any other risks, when the equipment is operated.

Acquisition teams and local procurement teams

17. Acquisition teams and local procurement teams are those responsible for activities that relate to the ordering and receiving of goods, materials, supplies, equipment, and services. This responsibility may include the sourcing, negotiation, contracting, the monitoring of supplier's performance and assuring compliance with operational protocols.

18. Defence acquisitions teams are to make sure that all equipment, machinery, and platforms that are purchased or supplied comply with the relevant statutory requirements or allow for compliance in the context of the planned or foreseeable use of the equipment.

19. All new equipment, machinery, and platforms are to be technically engineered to eliminate or minimise vibration exposure to the users and others to a level that is ALARP and therefore lower the risk of vibration induced damage, and other associated risks, when operated. Certain vehicles are known to be potentially significant sources of vibration, including off road vehicles, tracked vehicles, armoured vehicles (tracked and wheeled), fast boats, and certain ships and aircraft.

20. Additionally, it is imperative that such technical control measures and risk controls **should** be addressed throughout the procurement stages to avoid the associated costs and technical limitations of system redesign if the equipment, machinery, or platform exceeds the EAVs in the Legislation when used. Specialist vibration expertise, for example by a competent person or a professional vibration engineer, may be required to help define requirements or plan a programme of work. Technical control measures **should** include progressive risk mitigation through the:

- a. identification of the vibration requirements of the equipment, machinery, or platform;
- b. assessment of potential vibration exposure to personnel in the foreseeable intended use of the system; and
- c. demonstration and assessment of actual vibration emissions from a representative sample of the equipment, machinery, or platform in representative usage.

21. The determination of appropriate control measures against high amplitude and / or impulsive vibration is complex and challenging, and it will require particularly specialist experience and expertise. Effective protective or control measures against such high amplitude shock or vibration are highly likely to require **fundamental** engineering of the platform or equipment and **should** be considered at the earliest opportunity in the equipment procurement and acquisition process. Failure to do this is likely to result in serious impacts on the acquisition program and the resulting capability.

22. The Supply of Machinery (Safety) Regulations 2008 require manufacturers and suppliers of machinery to make sure that the design and construction of equipment eliminates or reduces vibration emissions to a minimum, while taking into account technical limitations. Note, however, that this does not apply to machinery that is designed and constructed exclusively for military or police purposes (not available on the civilian market).

23. Defence acquisition teams are to make sure that where vibration exposures are likely to be greater than the EAVs detailed in the Legislation that:

- a. the vibration sources are identified;
- b. the information is recorded in the safety case⁴; and

⁴ Safety cases **should** be produced for equipment and platforms (ships, boats, vehicles, and aircraft) and identify the location of the vibration hazards produced by the equipment and / or platform.

c. appropriate information on vibration levels and any equipment provided to reduce vibration exposure is supplied to the end user to ensure correct installation, use and maintenance.

24. Defence personnel with local purchase responsibility and / or hiring equipment or machinery locally are to make sure that the equipment is suitable for the activity being undertaken, and that it is supplied with sufficient information to assure its safe use in accordance with manufacturer's instructions and that this information is passed on to the end user.

Commanders, managers, and accountable persons

25. The key responsibilities for commanders, managers or accountable persons may include but are not limited to the following :

- a. management responsibilities, for example unit commanders at all levels in a military context or personnel line managers in a civilian context;
- b. engagement with competent person to correctly analyse hazards and risk control measures.
- c. responsibility for equipment or premises for example running workshops, training facilities, stores, and so on;
- d. responsibility for planning or managing activities, such as training activities or deployments;
- e. assisting with the development of internal standards policies and procedures;
- f. assisting senior leaders with establishing and meeting strategic and financial goals; and
- g. responsibility for procurement, design, selection, modification and so on, of equipment which may lead to vibration exposure of Defence personnel.

26. Therefore, this chapter defines the responsibility of a commander, manager, or accountable person as someone who has a delegated managerial or supervisory responsibility for activities or equipment that may result in the exposure of Defence personnel to excessive vibration whilst at work. The vibration levels **must** be managed through the use of control measures to reduce exposure to a level that is ALARP and tolerable. This includes design of equipment at the procurement stage to prevent or minimise vibration exposure to levels that are ALARP and tolerable.

27. The above definitions imply that there will likely be several individuals who together share responsibility for controlling vibration exposure. All personnel have a duty to work together to assess the risks and to assure that Defence is compliant with the policy statements and therefore the Legislation.

28. Whilst the primary responsibility for the welfare and H&S of personnel rests immediately with the managers of those personnel, this duty usually cannot be discharged without the proactive actions of other managers. This can take the form of directly supporting implementation of suitable control measures, review, and audit of an action plan, enforcing culture, standards of behaviour and adherence to policy, and so on.

29. The commander, manager or accountable person **should** first look at the site hazard assessment or safety case report, which **should** have identified the areas where work activities could produce excessive vibration and then conduct an initial assessment to identify whether there is a potential vibration hazard and whether a more detailed vibration risk assessment may be required. A 'Vibration Hazard Check Questionnaire' (VHCQ) is designed for this purpose and is presented in Annex C of this chapter.
30. The commander, manager or accountable person **should** make sure that a VHCQ is conducted by or in conjunction with a person familiar with the work environment and processes. The person does not need to have had vibration assessor training to undertake this task.
31. If the VHCQ identifies a vibration hazard, the commander, manager or accountable person are to arrange for a vibration risk assessment to be carried out following the guidance in Annex B of this chapter and consider using a competent person in this assessment if they are not competent themselves.
32. A Competent Person can assist the commander, manager or accountable person with the development of an action plan to mitigate the findings of the vibration risk assessment.
33. Suitable control measures **should** be developed in consultation with personnel and where appropriate Trade Union appointed and / or employee safety representatives.
34. When used, the [MOD Form 5053 Hand Arm Vibration \(HAV\) Pre-exposure Health Surveillance Self-Assessment](#) and [MOD Form 5055 Whole Body Vibration \(WBV\) Pre-Exposure Health Monitoring Self-Assessment](#) **should** be referenced on the activity vibration risk assessment in line with Chapter 8 of JSP 375, Volume 1.
35. Specialist support from SMEs may be required for the assessment of shock or extreme vibration levels.
36. Shock vibration sources typically exhibit very high vibration levels over very short periods of time, for example vibration due to fast boats impacting waves, harsh bumps in vehicles moving off-road, firearms discharge, explosive events, percussive machine working and so on.
37. Extreme vibration can occur particularly in Armoured Vehicles (tracked and wheeled) travelling on or off road or in specific locations onboard ship influenced by machinery vibration, for example.
38. The determination of appropriate mitigation measures against high amplitude impulse or vibration is particularly complex and challenging. Retrospective introduction of effective control measures is often impracticable, and managers are advised to engage with senior stakeholders on how to discharge their duties under this policy and the Legislation.
39. Activities where a detailed, specialist vibration risk assessment and associated safety method statement is to be completed, it includes but is not limited to:
- a. tests, trials, and exercises on tracked vehicles being driven on or off-road or wheeled vehicles being driven off-road. This is particularly important if the vehicles are new and the vibration experience with them is limited; and

- b. tests, trials, and exercises on fast boats.
- c. any equipment that is assessed to have an excessive ELV.

40. Where personnel are exposed to vibration which is likely to be at or above the EAV, the commander, manager or accountable person are to provide suitable information, instruction, training and supervision to such personnel. The training, where appropriate, **should** include:

- a. an understanding of the vibration hazard personnel may be exposed to and knowledge of the potential risks that the work activity may have on themselves and other personnel;
- b. the equipment and operating conditions that generate the vibration;
- c. the required control measures (advice can be provided by the competent vibration assessor);
- d. the need for vibration health surveillance as an aid for early detection of vibration induced damage and enabling early action to be taken to prevent any further damage; and
- e. identification of vibration induced damage symptoms (for example tingling and numbness in the fingers for HAV, or fatigue, headaches, or loss of balance for WBV).

41. Occupations and activities for which vibration health surveillance is to be undertaken due to high levels of vibration exposure includes, but is not limited to:

- a. personnel operating, or passengers in, Armoured vehicles (tracked and wheeled);
- b. personnel operating, or passengers in, wheeled vehicles off-road;
- c. personnel operating, or travelling in, high speed boats;
- d. personnel operating weaponry, for example small / medium automatic weapons;
- e. engineering units who regularly use machinery; and
- f. aircrew.

42. Special consideration is to be given to those who already suffer from a vibration induced condition or are particularly sensitive to damage. This includes, for example:

- a. young persons as per Chapter 19 of JSP 375 Volume 1 and HSE Guidance L141;
- b. pregnant women;
- c. personnel who have recently had surgical procedures;
- d. personnel with musculo-skeletal disorders (for example arthritis, tennis elbow, slipped spinal disc); and
- e. personnel with pre-existing medical conditions, for example a history of back pain, personnel with medical implants (pacemakers, artificial hips, metal plates / rods / screws), and so on

43. Advice on setting up vibration health surveillance programmes can be obtained through the local Services Medical Officer or Regional Occupational Health consultant (for Service personnel) and the relevant Defence organisation's safety organisation for civilian staff. Advice for civilian staff can be requested from the civilian occupational health contract via Defence Business Services (DBS) Civilian Human Resources (CHR).

44. If it is reported (either by the individual, by the Occupational Health department, or via the Defence organisation occurrence reporting system) that any Defence personnel have been diagnosed with vibration based occupational damage / disease such as hand arm vibration syndrome (HAVS), the commander, manager or accountable person **must** take action to remove those individuals from the vibration source SFAIRP, or where this is not possible, to introduce additional control measures to reduce their vibration exposure, for example by limiting time exposure and / or reducing machine vibration levels, to prevent their symptoms. If, however, an individual who is undergoing this process is showing progressive damage or worsening of symptoms then further reviews are to be held with regards to additional controls or redeployment to another area.

45. The commander, manager or accountable person **should** discuss with Occupational Health or Service Health units to assess whether to permanently remove the individual from the work activity and place them on alternative duties to prevent repeated exposure to vibration causing vibration induced damage. Repeated exposure to such vibration may lead to permanent damage or make such permanent damage worse.

46. If a commander, manager or accountable person has been informed that personnel have likely suffered harm as a result of vibration exposure, then a review of the vibration risk assessment is to be conducted to determine if it has adequately captured the risks and identified suitable risk controls. Additionally, the commander, manager or accountable person are to:

- a. review the exposure of all other personnel exposed to similar vibration doses and determine if they require referring to Occupational Health or Service Health units;
- b. make sure that Defence personnel working practices are monitored, for example that equipment is being used properly;
- c. make sure that all equipment / platforms are regularly maintained / repaired as appropriate and in accordance with manufacturers' instructions, to minimise the vibration produced and / or maximise the effect of control measures;
- d. keep records of such maintenance and repair which are to be kept up to date. All vibration control measures (for example dampening systems) on equipment and platforms are to be regularly inspected, and for any deficiencies to be promptly rectified and recorded as per Chapter 23 of JSP 375 Volume 1; and
- e. carefully assess the potential non-personal exposure risks and impacts associated with vibration in an appropriate Hazard Assessment or Safety Case. These may include structural or component failure due to vibration fatigue or loosening of fasteners and so on. While the commander, manager or accountable person might not be able to identify such associated hazards before they occur, they are to consider the potential impact where high vibration has been identified, with reported consequent impacts on the material condition of equipment. The examples below highlight the potential seriousness of high vibration;

(1) vibration induced failure of a throttle linkage system which led to uncontrolled 'full speed' acceleration of a vehicle, with severe consequences; and

(2) extreme vibration in a tracked AFV causing cameras to 'white out' at approximately 40 kph, leaving the driver effectively blind. The same vibration also caused flat-panel screen swivel joints to loosen, resulting in them swinging between the driver's controls, resulting in the AFV veering off track and colliding with trees.

Retention of records

47. All records including the establishment / unit / platform register, risk assessments, and so on **should** be kept in accordance with Chapter 39 of JSP 375 Volume 1.

48. All vibration and risk assessments, vibration health surveillance, training, and maintenance records **should** be kept for a period of no less than 60 years and in accordance with Chapter 39 of JSP 375 Volume 1.

Further support and guidance

49. Where this chapter has not provided sufficient guidance for a particular Defence activity, further advice may be sought from the Defence Medical Services (DMS). This is made up of the Royal Navy Medical Service, the Army Medical Service, and the Royal Air Force Medical Service. Other institutions include the Royal Airforce Centre of Aviation Medicine (RAFCAM), the Institute of Naval Medicine (INM) and Environmental Monitoring Team (EMT).

Related documents and guidance

50. The following documents are related to this chapter.

- a. JSP 375 Volume 1
 - (1) Chapter 2 - Military and Civilian Workplace Safety
 - (2) Chapter 6 - Safety Signs
 - (3) Chapter 8 - Safety risk assessment and safe systems of work
 - (4) Chapter 14 - Occupational health, health surveillance and health monitoring
 - (5) Chapter 15 - Personal Protective Equipment
 - (6) Chapter 19 - The Health and Safety of Young Persons
 - (7) Chapter 20 - New and expectant mothers
 - (8) Chapter 22 - Work equipment
 - (9) Chapter 23 - Electrical Safety
 - (10) Chapter 39 - Retention of Records
- b. JSP 418 - Management of Environmental Protection in Defence
- c. JSP 950 - Medical Policy (various Leaflets)
- d. MOD Form 5051 - Personal Exposure and Health Surveillance/Monitoring Record

- e. MOD Form 5053 - Hand Arm Vibration (HAV) Pre-Exposure Health Surveillance Self-Assessment
- f. MOD Form 5054 - Hand Arm Vibration (HAV) Health Surveillance Self-Assessment
- g. MOD Form 5055 - Whole Body Vibration (WBV) Pre-Exposure Health Monitoring Self-Assessment
- h. MOD Form 5056 - Whole Body Vibration (WBV) Annual Health Monitoring Self-Assessment
- i. HSE guidance
 - (1) INDG163 - Risk assessment: a brief guide to controlling risks in the workplace.
 - (2) HSG268 - The Health and Safety Toolbox: How to Control Risks at Work.
 - (3) HSE, Hand-Arm Vibration: Guidance on regulations, L140, HSE, 2019.
 - (4) HSE, Whole-Body Vibration: Guidance on regulations, L141, HSE, 2005.
 - (5) HSE - "Reducing Risks, Protecting People. HSE's Decision-Making Process," HSE, 2001.
 - (6) HSE - Health surveillance for HAVS - Guidance for Occupational Health Professionals

References for further reading

51. The following references are related to this chapter.
- a. The Ministry of Defence, "Ajax Noise and Vibration Review," 15 December 2021. [Online]. Available: <https://www.gov.uk/government/publications/ajax-noise-and-vibration-review/ajax-noise-and-vibration-review>. [Accessed 2022 April 8].
 - b. The Health and Safety Executive, "Gloves and Warm Clothing," HSE, [Online]. Available: <https://www.hse.gov.uk/vibration/hav/campaign/foundries/warmclothing.htm>. [Accessed 25 March 2022].
 - c. The Health and Safety Executive, "Exposure Points System and Ready-Reckoner," [Online]. Available: <https://www.hse.gov.uk/vibration/hav/readyreckoner.htm>. [Accessed 15 March 2022].
 - d. The Health and Safety Executive, "Whole Body Vibration Calculator," 15 March 2022. [Online]. Available: <https://www.hse.gov.uk/vibration/wbv/calculator.htm>. [Accessed 15 March 2022].

Vibration Exposure Terminology and Explanation

Measures of vibration exposure and applicable limits

1. There are thresholds of vibration exposure, above which key obligations or actions become necessary. These thresholds for the Exposure Action Values (EAV) and the Exposure Limit Values (ELV) for both HAV and WBV are presented in the table below.

	Exposure Action Value (EAV)	Exposure Limit Value (ELV)
Hand-Arm Vibration (HAV) ⁵	2.5 ms ⁻² A(8)	5 ms ⁻² A(8)
Whole Body Vibration (WBV) ⁶	0.5 ms ⁻² A(8)	1.15 ms ⁻² A(8)

Table A-1 – Daily vibration exposure action and limit values for HAV and WBV

2. The EAVs and ELVs presented in Table A-1 are relatively complicated time-averaged, frequency-weighted vibration exposure levels. They are calculated from the average frequency-weighted vibration level⁷, for example 2.5 ms⁻², and the square root of the proportion of time over which personnel are exposed to that average vibration level during a working day (8 hours) or working week (40 hours).

3. As per the Legislation (CVAWR 2005), the values presented in Table A-1 are shown for a nominal 8-hour working day or a nominal 40 hour working week^{8 9}. This means that, for example, if an individual were exposed to an average vibration of 2.5 ms⁻² when operating hand tools, or 0.5 ms⁻² when standing on a vibrating platform, for 8 hours in a day, or for 40 hours in a week, then their personal exposure has reached the EAV.

4. Likewise, if an individual was exposed to an average of 5 ms⁻² when operating hand tools, or 1.15 ms⁻² when on a vibrating platform for those same times, their personal exposure has reached the ELV. The concept of the time-averaged vibration exposure level is expanded upon in the section below.

5. The EAV refers to the amount of personal vibration exposure which, if reached or exceeded, requires a specified action to be taken to reduce the risk of exposure. If the EAV is exceeded then the commander, manager or accountable person **must**:

⁵ HAV thresholds are assessed against the combined vibration average of all orthogonal axes: x, y and z.

⁶ WBV thresholds are assessed against the separated vibration average of one orthogonal axes: x, y or z.

⁷ Defined as the root mean square, or RMS, acceleration levels. The levels are 'weighted' depending on the point of application to the body and the direction of the vibration.

⁸ The Legislation is based on a worker being exposed to workplace vibration for 8 hours a day or for 40 hours per week. This definition has significant implications for Defence personnel who may be in a 'workplace' for 24 hours per day for 7 days per week, requiring a significant reduction in the average vibration level to which they can be exposed before reaching the Action Values or Limit Values.

⁹ If the vibration 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.

- a. make a suitable and sufficient documented vibration risk assessment to ascertain the risk to H&S from the vibration. Personnel at particular risk, for example due to health reasons, **must** be considered;
 - b. make sure that the risk from exposure to the vibration is eliminated at source. If this is considered as not being reasonably practicable, the level **must** be reduced to a level ALARP and tolerable;
 - c. place individuals under a suitable vibration health surveillance where the vibration risk assessment indicates a risk to the H&S of those personnel; and
 - d. provide personnel and their representatives with suitable and sufficient information, instruction, and training.
6. The ELV refers to the level of personal vibration exposure which **must** not be exceeded.

Average vibration levels and vibration exposure time

7. Vibration levels can vary significantly over time, exhibiting different behaviours for different types of source. This is illustrated below.

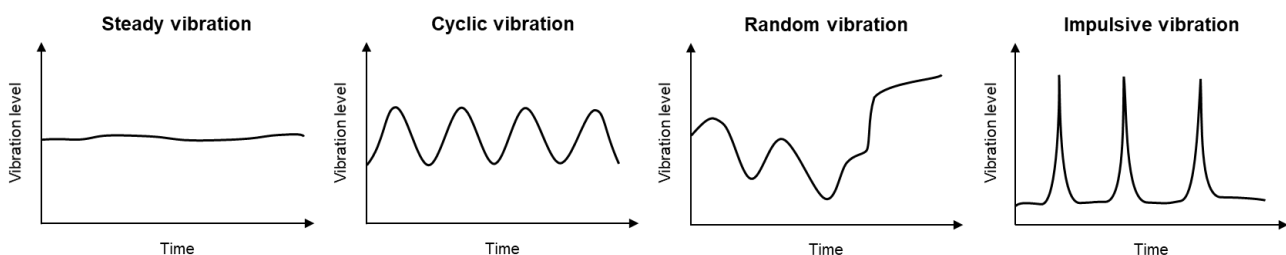


Figure A-1 – Example of fluctuating vibration levels

8. The ‘time averaging’ of a combination of significantly different vibration exposures during a single working day is relatively complicated, requiring a root mean square type averaging process. A precise definition of the vibration exposure levels is not required to understand the obligations of the Legislation and Defence Policy but is available for the interested reader. The key point of note is that halving the average vibration level whilst increasing the exposure time by a factor of four will produce the same overall vibration dose.
9. As a simple HAV example, during an 8-hour working day, assuming an average vibration level (RMS) at the hand of an individual of 1 ms^{-2} for 4 hours, 2 ms^{-2} for 3 hours and 2.5 ms^{-2} for the remaining 1 hour. The overall level for the 8-hour day is calculated by taking the time-average¹⁰ of the different average vibration levels over the full period whilst accounting for the time of each exposure. This indicates an average daily exposure of approximately 1.7 ms^{-2} for the day. The same principle can be applied to WBV.

¹⁰ The time-weighted average can be obtained using the HSE’s HAV or WBV calculators, or from the assistance of a competent person.

10. The simple HAV example is a limited explanation and is provided as an example of the cumulative effect of exposure time at different average vibration levels for non-expert readers. An understanding of exposure computations is not required by the commander, manager or accountable person. These computations are best undertaken by a competent person.

11. A relationship exists between vibration level and allowable exposure time based on receiving an 'equal energy vibration dose'. This means the same dose values can be achieved by trading off average vibration level with total exposure time. An example of this for HAV is detailed in the table below.

Vibration Magnitude (ms ⁻²)	2	2.5	3	4	5	6	7	8	10	14	20
Approximate Time to Reach HAV Exposure Action Value (EAV) (hours)	12½	8	5.5	3	2	1.5	1	¾	½	¼	7m
Approximate Time to Reach HAV Exposure Limit Value (ELV) (hours)	>24	>24	22¼	12½	8	5½	4	3	2	1	½

Table A-2 – Exposure times to receive EAV and ELV for HAV

12. A similar table has been created for WBV for a different range of vibration magnitudes using the HSE's WBV calculator. This is presented in the table below.

Vibration Magnitude (ms ⁻²)	0.2	0.3	0.4	0.5	0.75	1	1.5	2	2.5	3	5
Approximate Time to Reach WBV Exposure Action Value (EAV) (hours)	>24	22	12½	8	3½	2	1	½	20m	¼	5m
Approximate Time to Reach WBV Exposure Limit Value (ELV) (hours)	>24	>24	>24	>24	19	10½	4¾	2¾	1¾	1¼	½

Table A-3 – Exposure times to receive EAV and ELV for WBV (created using the HSE's WBV calculator)

13. In some instances, personnel may be exposed to vibration 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 vibration 24 hours a day, 7 days a week. This **must** be considered during a vibration risk assessment by factoring (or normalising) the exposure values by the appropriate time spent in different vibration environments over the entirety of a 24-hour day and / or over a 7-day week.

14. The vibration exposure for an individual, calculated or measured over a working day and normalised to the nominal 8 hours, is termed the “A(8)” vibration exposure. This is sometimes referred to as the daily vibration exposure.
15. In some instances, the vibration exposure to personnel may vary considerably daily for example in a high risk, short duration use of construction equipment such as breakers or plant. In instances where observations over a single working day would be insufficient to assess vibration exposure risk, observations over a (nominal 40 hour) working week **should** be used.
16. Instances where vibration exposure varies considerably over time periods longer than one week **must** be identified as part of the detailed vibration risk assessment. Examples may include operational deployments, battlefield training exercises and so on. In addition to identifying the occurrence of such instances in the risk assessment, these high-vibration activities **must** all be individually quantitatively assessed for risk from vibration. Whilst averaging vibration exposure over a working week is allowed in the Legislation, averaging over longer time periods is not, and therefore the impact of infrequent high-vibration activities **must** be assessed and risk managed individually.

Vibration risk assessment process

The following section presents a process for undertaking an initial vibration risk assessment and a detailed assessment if it is found to be required.

Initial vibration risk assessment

1. The first step is to ascertain whether a vibration hazard is present. This is determined by completing the Vibration Hazard Check Questionnaire (VHCQ) in Annex C. The results of the VHCQ will determine whether a detailed vibration risk assessment is required. The VHCQ can be conducted by a commander, manager or accountable person and/or personnel familiar with the work environments and processes that generate vibration.¹¹
2. If the VHCQ indicates that there is a potential vibration exposure problem a detailed vibration risk assessment is required. This **should** be undertaken in conjunction with MOD Form 5051 and MOD Form 5054. These forms **should** be referenced on the detailed vibration risk assessment as per Chapter 8 of JSP 375, Volume 1.
3. As an approximate guide, a detailed vibration risk assessment is likely to be necessary for:
 - a. any proposed work activity where vibration exposure at a 'notable level' will be physically experienced at the hand for HAV or at the feet, buttocks or back for WBV;
 - b. personnel will be operating or riding in Armoured vehicles (tracked and wheeled) and other tracked vehicles on or off-road, or wheeled vehicles off-road;
 - c. personnel will be operating or riding in fast boats or in vehicles or equipment of any nature on or off road for example; B vehicles, AFV, C vehicles, plant and equipment, tracked or wheeled.
 - d. Aircrew and passengers; and
 - e. personnel with any prior vibration induced symptoms or who are medically susceptible.
4. It is difficult to define a 'notable or significant' vibration level that can be accurately judged by a non-expert. If in doubt, then initiate a detailed vibration risk assessment. However, a notable or significant vibration level may be present if:
 - a. the vibration causes any sensation other than one where you simply 'feel' the vibration (for example, tingling, numbness, blurred vision, pain);
 - b. the vibration feels greater than you would expect sat in a motorcar driving on maintained roads;
 - c. the vibration causes fastenings (for example nuts and bolts) to loosen; and
 - d. the vibrating surface can be seen to vibrate with the naked eye.

¹¹ Note that certain questions in the VHCQ may require answers that are medically confidential, and such confidentiality **must** be respected, whilst making sure that appropriate risk factors are highlighted.

Detailed vibration risk assessment

5. The detailed vibration risk assessment **must** be completed by a competent person (CP). Expertise by the CP can be sought in conjunction with specialist advisors, for example engineers, and plant maintainers as necessary.
6. If a suitable 'in-house' CP is not immediately available, then timely action is required to source an external CP. It is suggested that no more than 3 months is allowed between the determination of a need for the detailed vibration risk assessment and its execution. In the case where extreme vibration levels or repeated shock is anticipated, then the relevant activity **should not** be undertaken until the detailed vibration risk assessment has been completed.
7. It has been noted that within Defence, the evaluation of vibration exposure risks can be delayed for a year or more due to CP availability. Such delays are both harming individuals and damaging the capabilities of Defence and **must** be limited SFAIRP. If delays exceed 3 months or are beyond the dates of anticipated extreme vibration or shock activities, then the issue **should** be escalated up the chain of command to facilitate suitable resolution, including ensuring that the senior leadership team are fully aware of the potential risks.
8. The detailed vibration risk assessment **must** be developed in consultation with the Defence personnel concerned and where appropriate Trade Union appointed and / or employee safety representatives.
9. The detailed vibration risk assessment **must**:
 - a. fully identify the work activity and identify all the vibration sources to which personnel are exposed;
 - b. identify where the risk is, for example vibration from a single unit of machinery and / or an activity;
 - c. identify which personnel are likely to be affected;
 - d. identify what engineering and management controls need to be taken to control the immediate risk;
 - e. identify, detail, and prioritise the long-term engineering and management controls;
 - f. contain a reliable estimate of the vibration levels and personal vibration exposures;
 - g. record the time exposed to such vibration levels;
 - h. include an assessment of the predicted or measured vibration exposure levels against the EAVs and ELVs in the Legislation for either HAV or WBV; and
 - i. recommend the type of instruction, information, and training, needed to educate personnel on the dangers of vibration exposure.

10. The detailed vibration risk assessment **must** be based on:
- reliable relevant information, for example measurements from equipment or activity used in the workplace;
 - if such information is not available, information from similar workplaces, or data from suppliers of the equipment;
 - consideration that differences may exist due to the particulars of equipment installation and usage; and
 - estimations of personal exposures from the vibration sources.
11. A timetable **should** be established for the completion of the assessment and the implementation of the subsequent engineering and management controls.
12. Where a vibration risk assessment is carried out, the hierarchy of risk control measures **must** be used. The hierarchy of risk controls is illustrated in Figure B-1 below and must guide the development of the detailed vibration risk assessment and it may be that action is necessary in more than one area to create a safe working environment.

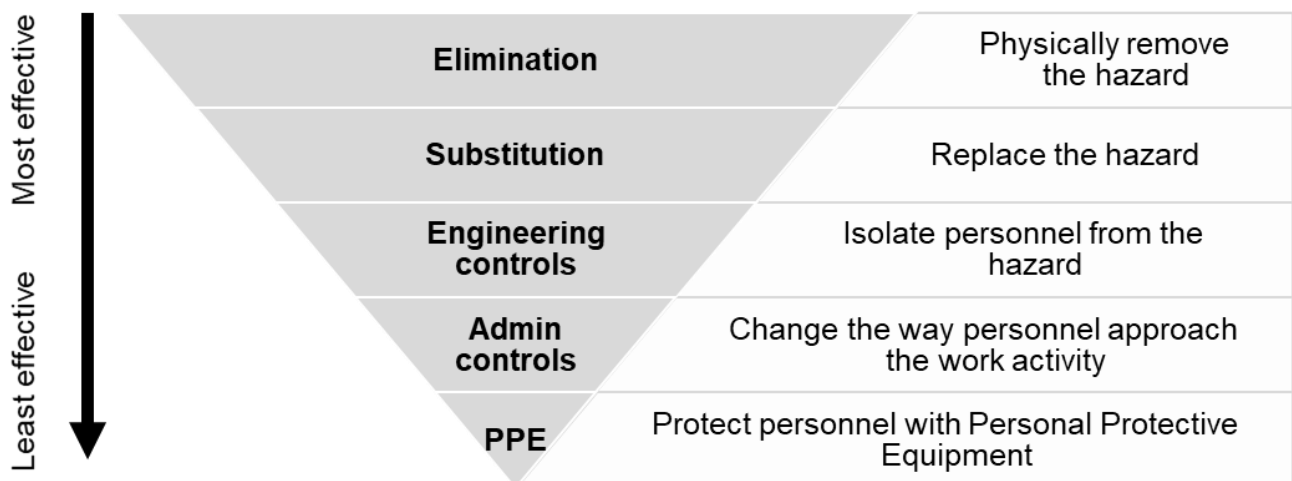


Figure B-1 – Hierarchy of Risk Controls

13. Plan a thorough walk-around to observe and note all areas and work activities where personnel are exposed to the vibration. During the walk-around, list all possible proportionate engineering and management controls which could minimise the exposure to vibration. Consider whether such controls are compatible with the working methods of the work activity.

The vibration source (planning)

14. If vibrating hand tools are required for the work activity, consider whether the manufacturer has supplied vibration magnitude data to help inform exposure time assessments. If there is no magnitude data available from the supplier, for example because the equipment predates the practice, then the risk assessor **should** make the recommendation to :
- have the tool removed from service, quarantined and replaced with a newer item for which magnitude data is provided by the supplier; or

b. have the tool sent to an institution where its vibration magnitude can be accurately measured, for example the RAF Centre of Aviation Medicine (RAFCAM) or the Institute of Naval Medicine (INM). Externally contracted organisations can also fulfil this function if required.

15. When planning the assessment, consider whether the vibration can be reduced 'at source'. For example:

- a. can the source be eliminated?
- b. can the number of sources be reduced?
- c. can the sources be moved away from personnel or vice versa?

16. When planning the assessment, consider the characteristics of the vibration sources. For example:

- a. are the vibration levels steady?
- b. are the vibration levels cyclic?
- c. are the vibration levels random?
- d. what is the frequency of the vibration?
- e. is the vibration impulsive?

The vibration path (planning)

17. When planning the assessment, consider all the relevant routes of exposure. For example, from direct contact with the vibrating machine or tool, or via the structure or workpiece being machined.

The vibration receiver (planning)

18. When planning the assessment, consider the receivers who are or who may be exposed to the vibration. For example:

- a. identify all exposed groups. This can include, for example:
 - (1) machine / tool / vehicle operators;
 - (2) vehicle passengers;
 - (3) maintenance personnel; and
 - (4) workshop assistants.
- b. identify all personnel whose health may be at particular risk from the vibration. This can include:
 - (1) pregnant women;
 - (2) personnel with a family or personal history of vibration induced damage;
 - (3) young persons;
 - (4) personnel working with or on vibrating equipment where there is a synergistic effect between vibration and any noise; and
 - (5) personnel with medical conditions (for example, arthritis, slipped spinal disc, tennis elbow, medical implants).

19. When planning the assessment, consider whether the work activity can be modified. For example:

- a. can fewer personnel be involved with the work activity?
- b. can personnel be rotated on the activity throughout the working day?
- c. can the rate of work be reduced (for example, vehicle speed, machine tool speed)?

20. When planning the assessment, consider if advanced operator training could reduce the vibration exposure. This is potentially of significant value for vehicle drivers (both land and sea) where expertise in 'reading the terrain' and carefully adjusting speed and course second by second can produce significant differences in vibration exposure levels.

21. When planning the assessment, consider whether the personnel require vibration health surveillance.

22. Implement the planned most effective and reliable engineering and management control measures required to control both the immediate risk to personnel and in the long-term. These may be controlled at the vibration source, path and / or receiver.

The vibration source (implement)

23. Implement an appropriate selection of engineering and management control measures at the vibration source. This includes, but is not limited to:

- a. elimination. For example, remove the equipment or activity entirely or switching off equipment when not in use;
- b. activity substitution. For example, replace the activity with one that produces less vibration. Note that substitution can introduce different risks into the workplace and these risks **must** also be considered;
- c. equipment replacement. For example, replace high vibration equipment / components with lower vibrating alternatives; and
- d. equipment modification. For example, operating at slower speeds, changing bearings, adding vibration isolation, or damping elements, adding tuned vibration absorbers.

The vibration path (implement)

24. Implement an appropriate selection of engineering and management control measures at the vibration path. This includes, but is not limited to:

- a. isolation. For example, using soft-grip handles, high performance vibration isolation seating, and so on; and
- b. rearrangement. For example, putting seating in a different location in a vehicle, altering the seating position (for example minimising side-to-side vibration and shock).

The vibration receiver (implement)

25. Implement an appropriate selection of the following engineering and management control measures:

- a. **Elimination.** For example, remove the person from the activity entirely. For example, use cameras or sensors to monitor equipment or spaces with high vibration levels, use motorised controls to actuate high vibration equipment;
- b. **Time.** For example, design the process to limit personal exposure or implement job rotation, move personnel away from vibration source for rest breaks or alternative work in low-vibration zones to spend time away from the vibration source whenever possible;
- c. **Location.** Those affected by vibration **should** be kept warm and dry as far practicable, taking into account the tasks required and any related safety considerations.
- d. **Discipline.** For example, provide appropriate training and ensure that all control measures are complied with; and
- e. **Surveillance.** For example, ensure that the vibration health surveillance results of Defence personnel are monitored, and appropriate follow-up action is taken.

26. Plans, policy documents and risk assessments **must** be revisited in an endeavour to achieve continual improvement in the reduction of risk to personnel.

27. The implementation of the engineering and management control measures determined by the detailed vibration risk assessment **must** be reviewed by the commander, manager or accountable person in conjunction with a CP. This is to determine whether the control measures have been adequately implemented. Each review **should** include the manager's assessment of the effectiveness of the control measures, and any further control measures that may be required, in conjunction with the CP.

28. A review **must** be completed initially after the detailed vibration risk assessment is completed, periodically thereafter and when there is a change in work activity.

29. If any review indicates that a previously highlighted vibration exposure issue remains which is impacting Defence personnel, then this could be as a result of wear and tear on a piece of equipment that has made it unserviceable or it may be indicative of a failure of the relevant vibration risk assessment itself: a failure to implement the findings of the detailed vibration risk assessment in a timely manner, or an incorrect selection of the engineering and management controls. This will cause further harm to personnel and damage to Defence capabilities.

30. The following guidance can be used to determine whether the vibration exposure control measures have been both implemented, and whether that they are proving effective.

Initial review

31. An initial review **must** take place shortly after the detailed vibration risk assessment is completed. This is to assess the immediate effectiveness of the controls. It is recommended the initial review takes place no longer than 3 months after the detailed vibration risk assessment is completed.

Periodic review

32. The control measures **must** be reviewed periodically by the commander, manager or accountable person supported by a CP as necessary. This **should** be at a frequency based on the change of risk but normally not exceeding every two years. The periodic review **should** assess the effectiveness of the control measures and whether a safe working environment is being achieved. In some circumstances formal audits may be useful.

Change in work activity review

33. Additionally, the control measures **must** also be reviewed by the commander, manager or accountable person and CP where there is a change or event in the work activity. For example:

- a. new vibrating equipment has been introduced, or other changes to the vibration levels are suspected;
- b. there are reports of vibration induced damage or harm;
- c. after an accident or near-miss where vibration could have been a contributory factor to the accident;
- d. a change in the point of application of the vibration to the body or the duration of exposure; and
- e. if there is any reason to suspect that the current detailed vibration risk assessment is no longer valid.

34. It is imperative that personnel at **all** levels across Defence learn from any accidents or incidents, ill health data, errors or relevant experience gained in the carrying out of their duties. Such incidents **must** be documented in the relevant risk assessment and controlled through the adoption of engineering and management control measures.

Managing vibration risks flow chart

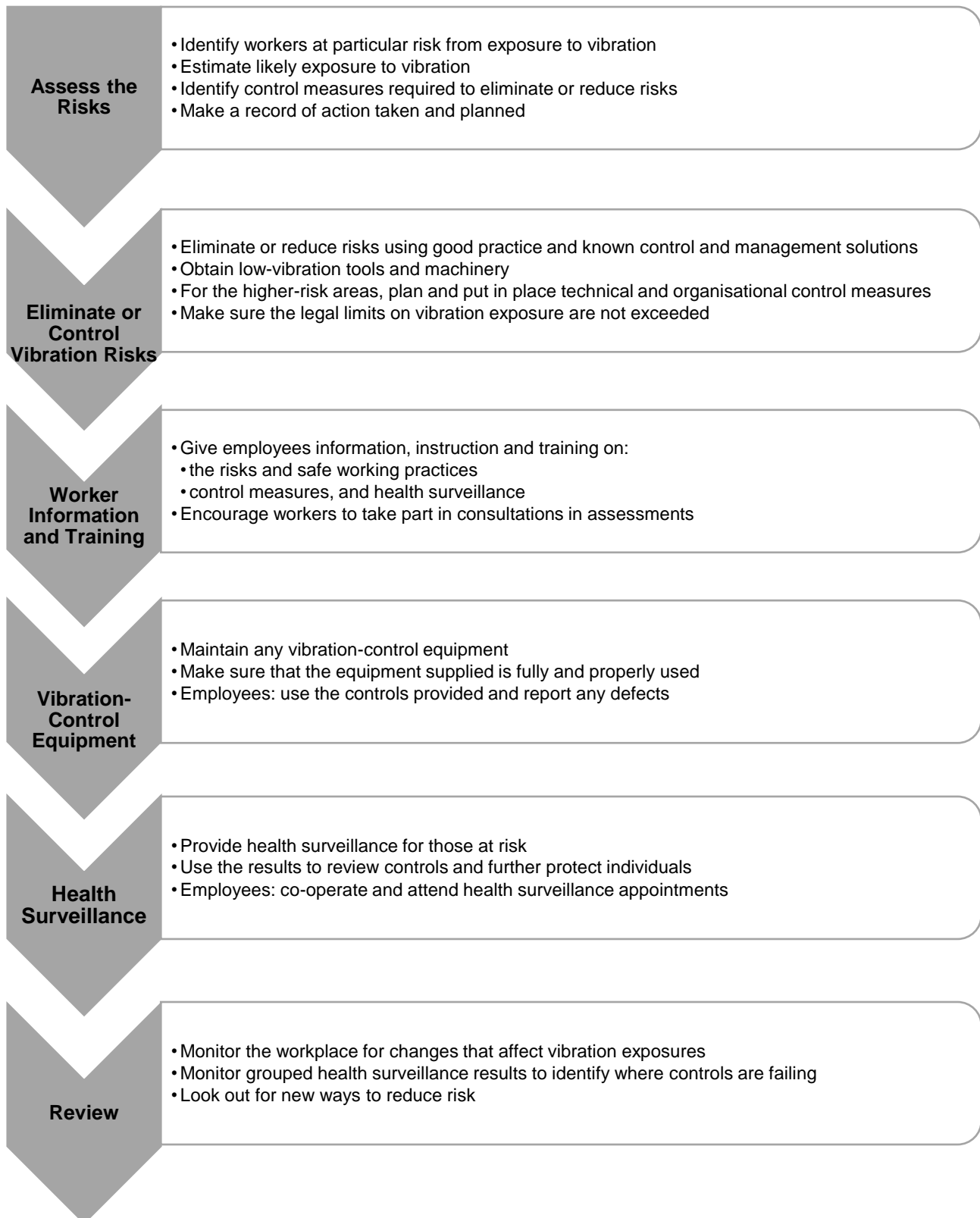


Figure B-2 – Flow chart to manage vibration risks

Vibration Hazard Check Questionnaire

1. The Vibration Hazard Check Questionnaire (VHCQ) is an initial assessment to ascertain the presence of a potential HAV and / or WBV hazard. If the answer is 'yes' to any of the checks in the tables below, a vibration risk assessment is required. Note that the questions, whilst specific, **should** also be interpreted more broadly as examples of similar situations not explicitly stated.

Name of person conducting the questionnaire		
Question	Y	N
Do personnel operate any hand-held or hand-guided or hand-controlled power tools as a regular part of their work?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel operate controls of Armoured vehicles (Tracked and Wheeled) either on or off-road?	<input type="checkbox"/>	<input type="checkbox"/>
Are personnel experiencing sensations of vibration or shock, for example through power tools or when operating a platform or vehicle?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel work in areas where vibration or shock may be present, for example on a construction site, engineering workshop, machinery space, weapon system or aircraft?	<input type="checkbox"/>	<input type="checkbox"/>
Has the vibration of equipment become progressively worse over time?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel have any numbness or tingling of the fingers lasting more than 20 minutes after using vibrating equipment?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel have numbness or tingling of the fingers at any other time?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel wake at night with pain, tingling, or numbness in their hand or wrist?	<input type="checkbox"/>	<input type="checkbox"/>
Have the fingers of any personnel gone white on cold exposure?	<input type="checkbox"/>	<input type="checkbox"/>
Have personnel noticed any change in their response to their tolerance of working outdoors in the cold?	<input type="checkbox"/>	<input type="checkbox"/>
Are personnel experiencing any other problems in their hands or arms?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel have difficulty picking up very small objects for example screws or buttons or opening tight jars?	<input type="checkbox"/>	<input type="checkbox"/>

Table C-1 – HAV hazard check questionnaire to determine a potential HAV problem

Name of person conducting the questionnaire		
Question	Y	N
Do the personnel ride in or on Armoured vehicles (Tracked and Wheeled) either on or off-road?	<input type="checkbox"/>	<input type="checkbox"/>
Do the personnel sit on construction vehicles?	<input type="checkbox"/>	<input type="checkbox"/>
Do the personnel ride in or on fast boats or similar craft that can 'slam' in water?	<input type="checkbox"/>	<input type="checkbox"/>
Is there currently any movement or activity that causes personnel pain in their back?	<input type="checkbox"/>	<input type="checkbox"/>
Have personnel suffered any back/neck/shoulder pain in the last 12 months?	<input type="checkbox"/>	<input type="checkbox"/>
Have personnel had to take any medication to deal with the pain experienced?	<input type="checkbox"/>	<input type="checkbox"/>
Have personnel had to seek medical advice regarding this pain?	<input type="checkbox"/>	<input type="checkbox"/>
Has this back/neck/shoulder pain resulted in personnel taking time off from work?	<input type="checkbox"/>	<input type="checkbox"/>
Have personnel had any accidents or injury to the back in the last two years?	<input type="checkbox"/>	<input type="checkbox"/>
Have personnel had any recent surgery?	<input type="checkbox"/>	<input type="checkbox"/>
Could the exposed personnel be pregnant?	<input type="checkbox"/>	<input type="checkbox"/>
Do personnel have any medical implants, such as pacemakers, defibrillators, pins, rods, plates, replacement joints, and so on?	<input type="checkbox"/>	<input type="checkbox"/>

Table C-2 – WBV hazard check questionnaire to determine a potential WBV problem.

Vibration assessor competency

1. Vibration assessors **should** have adequate knowledge / experience and skill to undertake the vibration risk assessment. Essentially, they **should** have: -
 - a. knowledge of The Control of Vibration at Work Regulations 2005 or where applicable either the Control of Vibration at Work (Northern Ireland) 2005 Regulations and / or the Merchant Shipping and Fishing Vessels (Control of Vibration at Work) 2007 Regulations.
 - b. knowledge of MOD policy, for example SofS Policy Statement and JSP 375.
 - c. the ability to assess and / or measure vibration.
 - d. knowledge on how to record and analyse results.
 - e. the ability to explain the results to others in simple to understand language.
 - f. the ability to interpret information provided by others, for example vibration data by equipment manufacturers.
 - g. the ability to identify appropriate control measures.
 - h. know the limits of their own knowledge and know when and where to seek further advice.
 - i. up to date competency and knowledge to address skill fade.
2. The MOD has a provision of accredited training run by the Institute of Naval Medicine (INM) at Gosport. The course entitled "The Management of Occupational Exposure to Hand Arm Vibration" is a 5-day course designed for those responsible for the hand / arm vibration management in the workplace. Successful candidates will be awarded a certificate by the accreditation body, the Institute of Acoustics. Course applications to be directed to AO1 via NAVYINM-TRAINING@mod.gov.uk or 023 9276 8091. Further advice can be obtained from Head of Acoustics and Vibration, INM on 023 9276 8080 or Military 9380 68080. Course duration: 4.5 days.
3. On successful completion of the training courses, personnel are requested to notify their local H&S and update their MyHR/JPA accordingly.
4. A competent person (CP) vibration assessor may be available from several sources. These include:
 - a. the local H&S adviser within the unit / establishment;
 - b. an appropriate engineering adviser;
 - c. Defence organisation's environmental or health personnel;
 - d. civilian occupational hygienists;
 - e. Defence organisation Safety Centre (SC) or equivalent; and.
 - f. the Chief Environment and Safety Officer (CESO) or equivalent.

5. If competent advice is not available from the above-mentioned sources, specialist in-house advice and expertise is available from the organisations listed in Table D-1 below. However, these resources are limited and enquiries from staff within these TLBs will be given priority.

Royal Navy Head of Acoustics and Vibration	Army Field Army Environmental Monitoring Team (EMT)	Royal Air Force Head of Noise and Vibration Division
Institute of Naval Medicine Alverstoke Gosport Hampshire PO12 2DL Email: NAVYINM-AVS@mod.gov.uk	Headquarters Field Army Environmental Monitoring Team (EMT) 2 nd Floor, Zone 7, IDL 435 Marlborough Lines Monxton Road Andover Hampshire SP11 8HU Email: FdArmy-Sp-EMT@mod.gov.uk	RAF Centre of Aviation Medicine RAF Henlow Bedfordshire SG16 6DN Email: AirCOSSpt-CAM-OEM-NVD-GpMbx@mod.gov.uk

Table D-1 – Specialist advice contact details

Managing vibration health surveillance

1. There are various ways in which exposure to vibration can cause health and / or safety hazards and impacts. The common symptoms, personnel at particular risk, and hazards of vibration exposure are set out in the following paragraphs.

Hand Arm Vibration

2. Hand Arm Vibration (HAV) may lead to difficulty in manipulating controls, particularly those requiring delicate inputs. This can lead to additional hazards from the equipment being controlled. Symptoms which may be indicative of HAV include:

- a. pain, tingling and numbness in the fingers, hands, wrists, and arms;
- b. in the cold and wet, fingers going white, then blue then red with sensations of pain; and
- c. loss of sensation or strength in the fingers and / or hands.

3. Personnel at particular risk of the hazards of HAV include;

- a. those who use hand-held tools for example; concrete breakers, disc cutters, chainsaws, grinders, hammer drills and so on; and
- b. those who use handles and hand-holds on vibrating machinery or vehicles, for example: controls on Armoured Fighting Vehicles AFVs, including driver's controls, gunner's controls, construction equipment and so on.

Whole Body Vibration

4. Whole Body Vibration (WBV) is exposure to vibration usually transmitted to the whole body from a supporting surface, seat, or a platform, for example part of a vehicle, ship, boat, or aircraft.

5. WBV is a result of shock induced injury and is dependent on the impact force of the shock together with the positioning of the person, for example standing where shock is transmitted through the feet to the spine. The direction of the shock relative to the person is also important, for example forces aligned with the spine produce different effects compared to those produced by forces at 90 degrees to the spine.

6. In addition to acute injuries at the time, long term exposure to even moderate levels of repeated shock may lead to chronic injuries to the spine.

7. Extreme shock levels can be experienced in certain situations, for example pilot ejection from aircraft, crew on or in Armoured Fighting Vehicles (AFVs) or fast boats. The shock levels have the capability to cause instantaneous injury. Exposure to levels below this can still cause injury in a matter of minutes. Injuries can include spinal fractures and internal bleeding.

8. Symptoms which may be indicative of WBV shortly after or during exposure include:
 - a. musculoskeletal pain, for example in the back or neck;
 - b. fatigue, blurred vision and / or headaches;
 - c. stomach problems and / or nausea; and
 - d. shakiness, dizziness and / or loss of balance.
9. WBV can also lead to motion sickness which is often overlooked when considering 'physical harm' that might occur, although the symptoms are likely to improve with exposure and therefore the 'cycle' at Figure E1 doesn't fully apply. Motion sickness, particularly at sea, can be exceptionally debilitating. Motion sickness in land vehicles **should** also be considered given its ability to impact military capability.

Vibration health surveillance and monitoring

10. Where the vibration risk assessment determines that Defence personnel are likely to be exposed to HAV, those personnel **must** conduct a pre-exposure self-assessment using MOD Form 5053 (If already exposed to HAV then the annual questionnaire part of MOD Form 5053 must be used). The pre-exposure self-assessments are used to identify those particularly at risk from the exposure to vibration and to determine the level of impact this may have on their health. Where the pre-exposure self-assessment has identified that personnel are at risk of HAV, in accordance with the legislation [Hand-arm vibration Guidance on Regulations L140 \(Reg 7 - para 37\)](#), they **must** be placed on a suitable [health surveillance](#) programme, which is set out in Chapter 14 of JSP 375 Volume 1.
11. Where the vibration risk assessment determines that Defence personnel are likely to be exposed to WBV, those personnel **should** conduct a pre-exposure self-assessment using MOD Form 5055 (If already exposed to WBV then MOD Form 5056 should be used instead of MOD Form 5055). The [Whole-body vibration Guidance on Regulations L141 \(Reg 7\)](#), states that health surveillance is not appropriate for WBV, and therefore recommends a less precise measure than the formal health surveillance approach, such as reporting and monitoring of symptoms, which is generally referred to as 'health monitoring'. Therefore, those personnel with significant risk of WBV **should** be placed under suitable health monitoring, which is set out in Chapter 14 of JSP 375 Volume 1.
12. Vibration health surveillance differs to routine medical assessment, for example a standard Physique, Upper limbs, Lower limbs, Hearing (right), Hearing (left), Eyesight right, Eyesight left, Mental function and Stability (emotional) (PULHHEEMS) assessment. This is because it targets selected personnel who are at particular risk of exposure to vibration at work.
13. MOD Form 5054 **must** be used to self-assess for symptoms of HAV, MOD Form 5056 **should** be used to self-assess for symptoms of WBV and MOD Form 5051 **must** be used to record the findings respectively. This **should** be undertaken in conjunction with a commander, manager or accountable person and / or a competent person. Figure E-1 illustrates the cycle of vibration health risk actions to take.

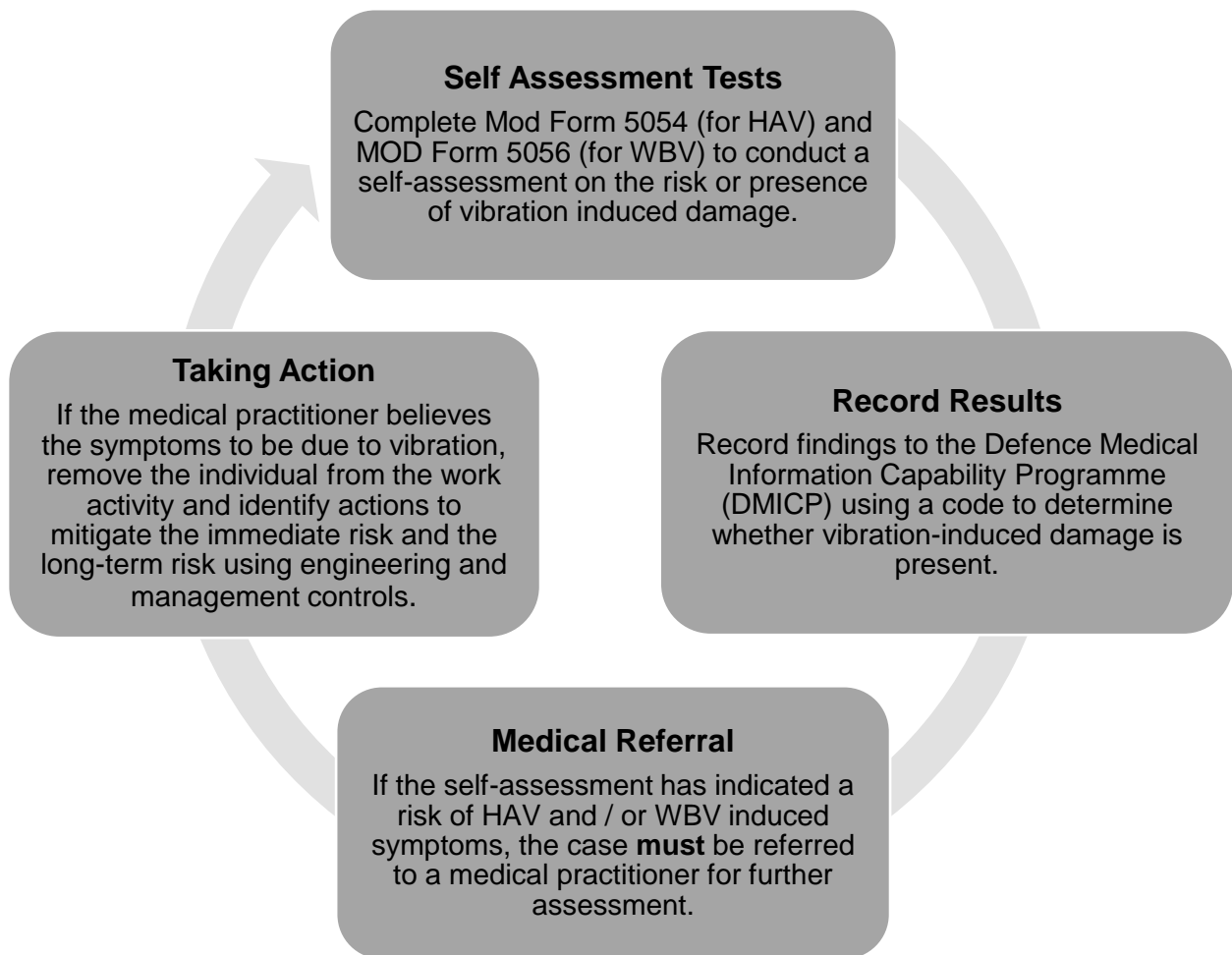


Figure E-1 – Cycle of vibration health risk actions

Hand Arm Vibration Ready Reckoner

1. Daily exposure to HAV can be estimated using the points-based system provided by the HSE. Using Table F-1, multiply the points assigned to the vibrating tool by the number of hours of use. Then compare the value with the EAV and ELV which, in points form, is approximately 100 and 400 points per day, respectively.

Tool vibration (m/s ²)	3	4	5	6	7	10	12	15
Points per hour (approximate)	20	30	50	70	100	200	300	450

Table F-1 – Simple ‘exposure points’ system

2. The sum of points for all tools for a working day can then be compared with the HSE’s ‘ready reckoner’ chart. This chart is reproduced in the below Table F-2.

Vibration magnitude (m/s ²)	40	265	800								
	30	150	450	900							
	25	105	315	625	1250						
	20	67	200	400	800	1200					
	19	60	180	360	720	1100	1450				
	18	54	160	325	650	970	1300				
	17	48	145	290	580	865	1150				
	16	43	130	255	510	770	1000				
	15	38	115	225	450	675	900	1350			
	14	33	98	195	390	590	785	1200			
	13	28	85	170	340	505	675	1000	1350		
	12	24	72	145	290	430	575	865	1150	1450	
	11	20	61	120	240	385	485	725	970	1200	1450
	10	17	50	100	200	300	400	600	800	1000	1200
	9	14	41	81	160	245	325	485	650	810	970
	8	11	32	64	130	190	255	385	510	640	770
	7	8	25	49	98	145	195	295	390	490	590
	6	6	18	36	72	110	145	215	290	360	430
	5.5	5	15	31	61	91	120	180	240	305	365
	5	4	13	25	50	75	100	150	200	250	300
4.5	3	10	21	41	61	81	100	160	205	245	
4	3	8	16	32	48	64	96	130	160	190	
3.5	2	6	13	25	37	49	74	98	125	145	
3	2	5	9	18	27	36	54	72	90	110	
2.5	1	3	6	13	19	25	38	50	63	75	
2	1	2	4	8	12	16	24	32	40	48	
1.5	0	1	2	5	7	9	14	18	23	27	
1	0	1	1	2	3	4	6	8	10	12	
	5m	15m	30m	1h	1.5h	2h	3h	4h	5h	6h	
	Exposure time, T										

Table F-2 – Hand-arm vibration ready reckoner

3. The key to the colours is presented in Table F-3.

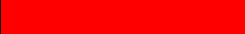




	Above ELV
	Likely to be at or above ELV
	Above EAV
	Likely to be at or above EAV
	Below EAV

Table F-3 – Hand-arm vibration ready reckoner colour chart

Exemption certificate process

1. Certain provisions in Health and Safety legislation allow the SofS to exempt a person or class of persons from parts of its requirements by issuing an exemption certificate which is set out in this Annex.

Note: Exemptions against [The Road Vehicles \(Construction and Use\) Regulations 1986 \(legislation.gov.uk\)](https://www.legislation.gov.uk) and the [The Road Vehicles \(Authorisation of Special Types\) \(General\) Order 2003 \(legislation.gov.uk\)](https://www.legislation.gov.uk) are granted by the Land Exemption Committee (LEC) and follow a separate exemption process. This process is set out in the Defence Land Systems Regulator (DLSR) SOP 3 - Legislative DEDs Process, which can be found on the [DLSR Legislation and Compliance](#) page. Applications for consideration by the LEC are to be made through the DLSR, to DSA-DLSR-HQ-LEG1@mod.uk.

2. An exemption certificate from legislation will only be granted where the SofS is satisfied that the person or class of persons involved in activities detailed in an Exemption Case Submission (ECS) are carried out in the interests of national security. Any exemption certificate granted is normally time limited (to a maximum of five years unless there are valid reasons for a longer period) and be subject to conditions.

3. Where the provisions of legislation cannot be complied with, and an exemption certificate is granted, control measures should be put in place to limit any safety risks to the person or class of persons to a level that is ALARP.

4. The ECS must demonstrate that the required exemption from the relevant Health and Safety legislation is in the interest of national security or to protect operational capability. The exemption will only be granted, once the stipulated conditions of the exemption have been satisfied. The ECS must include:

- a. the title of the relevant legislation in full to which the requested exemption applies including the specific section(s) or regulation(s);
- b. the person or group of persons affected by the non-compliance;
- c. the equipment, material or activity and intended use that is not, or will not be, compliant;
- d. the time period for which an exemption is required and the rationale for it;
- e. an outline of the reasons for the non-compliance. For example, if there is not an exemption certificate in place, how the proposed activity will be adversely affected; for example:
 - (1) the numbers of personnel placed at potential risk;
 - (2) the impact on front line operational capability; and
 - (3) the quantitative extent (magnitude) of the non-compliance.

- f. actions undertaken and / or considered to comply with the legislation;
- g. cost data where compliance is being ruled out on the grounds of cost;
- h. an action plan containing the mitigation control measures to be implemented, likely costs and timescales for compliance in the short and medium to long term;
- i. the plan for health monitoring and assessment where applicable; and
- j. where renewal of an existing exemption certificate is being sought, details on the success or otherwise of the previous action plan, including the results of health monitoring where applicable.

5. Preparation of the ECS by the sponsor¹² must include input from operating authorities, acquisition teams and medical personnel as appropriate. The draft ECS must be passed by the sponsor to relevant subject matter experts, including the appropriate Defence Safety Authority (DSA) Regulator for a recommendation on approval.

Note: For REACH exemptions, the ECS is to be directed through DE&S Quality, Safety & Environmental Protection (QSEP) to DESEngSfty-QSEPSEP-Reach@mod.gov.uk as outlined in JSP 418 Leaflet 5.

6. If the ECS is recommended for approval:

- a. for safety related exemptions that are requested in the interest of national security, the sponsor must forward the completed ECS and draft exemption certificate to the Director of Defence Safety (Dir DS) for endorsement. If the ECS is endorsed by the Dir DS, the sponsor is to forward the ECS and draft exemption certificate to the SofS for consideration.
- b. for exemptions requested to protect operational capability, the sponsor forwards the completed ECS and draft exemption certificate to the appropriate Approval Authority (AA) for consideration.

7. If the SofS/AA deem the case successful, a signed and completed exemption certificate will be issued to the sponsor by the SofS/AA. A copy of the completed exemption certificate (this includes REACH exemption certificates) together with any conditions that must be met, is to be provided to the Dir DS and the appropriate DSA Regulator by the sponsor.

8. If not successful, the activity must be ceased until such time as it can comply with the legislation or a new ECS has been approved.

¹² The sponsor is those that that would be holding the residual risk and / or receiving the benefit of the exemption, for example; this could be the Senior Responsible Owner or the User.

Template
EXEMPTION CERTIFICATE
(...name of Legislation and date....)

1. For persons undertaking [...name of activities to be exempt...] using [...name of equipment / system...].

2. [... name of Legislation and date....] cannot be complied with fully when undertaking [...name of activities to be exempt...] using [...name of equipment or material ...].

3. I, having considered the case made for exemption at Ref [...Exemption Case Submission reference...] do hereby exempt, in accordance with the power vested in me by virtue of regulation [...number...] of [...name of Legislation and date...], in the interests of national security/protecting operational capability, all persons undertaking [...name of activities to be exempt...] using [...name of equipment or material...].

4. This exemption is granted subject to the following conditions:

- a.
- b.
- c.

5. I may vary or revoke this Exemption at any time by a certificate in writing, and in any event this Exemption shall expire, unless renewed, on [...date...].

Signed..... Date.....

Certificate No:.....