Proceedings of the Institute of Acoustics

THE *CONTROL OF VIBRATION AT WORK REGULATIONS 2005* FROM AN HSE INSPECTOR'S PERSPECTIVE

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1 THE CONTROL OF VIBRATION AT WORK REGULATIONS

1.1 Background

The Control of Vibration at Work Regulations[1] (COVAW) will come into force from 6 July 2005 to implement in the UK, the harmonized European requirements set out in EU Directive 2002/44/EC[2] concerning control of risks from vibration in the workplace (the Physical Agents (Vibration) Directive). The aim is to protect citizens from harm caused by excessive occupational exposure to hand-arm or whole-body vibration[3].

These new Regulations do not place duties on suppliers, etc. of workplace machinery but do draw on expectations for vibration set out in earlier Regulations as amended[4] implementing European requirements set out in Directive 98/37/EC[5] concerning the approximation of laws relating to machinery (the Machinery Directive).

1.2 Principal requirements

The COVAW Regulations require action of employers in 4 main areas:

Evaluation of risk from vibration including assessment, and if necessary measurement, of exposure;

A programme of technical and/or organisational measures to minimize exposures and the attendant risks;

Information and training for vibration exposed workers; and

Appropriate health surveillance.

1.3 Exposure assessment and risk assessment

A risk assessment should identify the measures that are available to combat risk and record the reasonable practicability of adoption of each of the measures in the particular circumstances. Exposure assessment will determine actions required according to exposure action and limit values. Exposure assessment is a surrogate for full risk assessment and will not identify all cases where risk exists – especially for whole-body vibration. Results of health surveillance for hand-arm vibration and less rigorous health monitoring for whole-body vibration should be used to check that risk is under control. Implementation of effective control measures is more important than extensive quantification of exposures.

Hand-arm and whole-body vibration data used in management of workplace risks arising from excessive exposure is usually either:

Data supplied with machinery by manufacturers according to Standard tests; or

Data collected in workplaces representative of the intended use of the equipment.

The purposes of quantifying workplace exposure to vibration are threefold:

To determine what legal duties apply, e.g. by comparison with the exposure action value and exposure limit value;

To assess risk through known relationships between dose and response; and

To quantify the likely change in vibration exposure following modification of the working practice.

The regulations require action wherever risk is identified and where exposure is likely to exceed the exposure action value. In view of the large uncertainty in estimates of the daily exposure, for example ± 40-50% is thought to be typical for hand-arm vibration even when based on measurements in the workplace, it will be prudent to assume the exposure action value is likely to be exceeded, and take the actions, even if the calculated exposure value is a little below the exposure action value.

If measurements are required, sufficient number of measurements should be made to describe fully the likely ranges in exposure. Many measurements of exposure to hand-arm vibration have been made in recent years and in many instances measuring will add little to the knowledge base but it can occasionally help make decisions on control action.

While the exposure limit value establishes a maximum allowable exposure, employers should not work to this level (for example when managing exposure by restricting exposure duration). They are required to reduce the exposure to the lowest level reasonably practicable (Reg 6(2)) and this should be the primary objective, whether or not the exposure limit value is exceeded.

1.4 Control measures

Satisfactory management of risk could be achieved in many ways and will usually be a combination of including:

following established good industry practice for the process;

avoidance of unusually high vibration equipment;

working in accordance with machinery manufacturers recommendations; etc.

The COVAW Regulations do not place any duties on manufacturers or suppliers but do draw on expectations of safety information supplied, for example, according to the Machinery Directive whereby manufacturers are obliged to provide equipment that can be used without risks to health and safety. Amongst other requirements, manufacturers should reduce the risks from vibration to the lowest levels that can be reasonably achieved. Where they cannot eliminate risks at source or by protective measures a warning of the residual risks must be provided.

2 PARTICULAR ISSUES FOR HAND-ARM VIBRATION

2.1 Workplace exposures and risk

We know from past measurements that use of the better rotary tools will usually result in the exposure action value of 2.5 m/s^2 A(8) being exceeded within 1 hour and the exposure limit value of 5 m/s^2 A(8) within 4 hours. Older designs of rotary tool can exceed the exposure **limit** value within a few minutes.

Use of the better percussive tools will usually result in the exposure action value being exceeded within about ¼ hour and the exposure limit value being reached well within 1 hour. Some older designs of percussive tool can only be used for 2 or 3 minutes.

Many competing powered hand tools continue to have widely different vibration emissions. Selection between tools remains an effective way of minimizing hand-arm vibration exposures.

2.2 Hand-arm vibration information from manufacturers

It is widely recognised that declared vibration emission values measured using laboratory-based test codes can be misleading with regard to the likely vibration magnitudes in real use. (This is because they are often single axis values measured in unrealistic operating conditions.) While these values can assist comparison of vibration emissions when selecting suitable equipment, HSE's guidance encourages the provision by tool manufacturers of representative in-use vibration data or equivalent information to warn users and help them assess, control and manage vibration risks.

Employers should try to obtain information on the likely (range of) magnitudes for the actual tool type and work process, but in many cases generic information on likely vibration values for broad tool categories will be sufficient to establish the likelihood of exceeding the exposure action value. In the absence of any other information, recent work has indicated that, for many tools, doubling the declared emission value will give a more realistic indication of the tri-axial in-use magnitude, and this may be sufficient, at least to identify the need for control.

A 'traffic lights' system, now widely used in the tool hire industry, is welcomed because it provides many employers (in the construction industry in particular) for the first time with information to help them manage vibration exposures from the use of hired tools. HSE is currently working with the industry to improve the quality of data and the guidance that accompanies this system.

2.3 Control strategies

The Regulations require action to identify eliminate or at least minimize risk from vibration wherever risk exists or when the exposure action value of 2.5 m/s^2 A(8) is exceeded.

The improving availability of vibration information, such as the tool hire industry initiative, tends to encourage employers to use exposure time limits as their main means of controlling exposure and risk. While this can help keep exposures below the exposure limit value, it is unlikely to result in the lowest exposures reasonably practicable, unless the following approaches are already in place:

work process selected to avoid or minimise vibration exposure;
the most suitable work equipment is selected for the job;
equipment is properly maintained to prevent increased vibration;
operators have the necessary training and supervision to minimise vibration risk.

Where control of exposure duration is required, employers should set their time limits to obtain the lowest exposure that is reasonably practicable, preferably below the exposure action value and certainly below the exposure limit value. The 'exposure points' system described in new HSE guidance is proving popular for this (and for exposure assessment). A 'ready reckoner' is available for this and daily exposures can be calculated and managed using simple additive numbers (not A(8) values).

In many cases where operators are at risk of developing HAVS, the problem will have been faced, addressed, and perhaps resolved elsewhere in the industry. Where the control techniques are well known –tools suitable for the job, good operator techniques, effective processes, etc. – and it is established that vibration exposures will be acceptable there is little more to be done than follow good practice.

HSE's priority for the immediate future is to assist industries find means of complying with the exposure limit value, where it is not already reasonably practicable to do so, during the transition period allowed for in the Regulations.

2.4 Vibration measurement

HSE's new guidance contains minimal technical information on the measurement of hand-arm vibration exposures in the workplace. As discussed above, the guidance concentrates on helping employers to assess risk and exposure sufficiently to identify the control measures required, and this does not require a highly precise quantification of daily exposure. This will sometimes require measurements, but this is not the general case.

Where measurements are required, they should be conducted by someone with appropriate knowledge and experience and in accordance with the appropriate Standards[6,7].

2.5 Information and training for workers exposed to hand-arm vibration

Exposures close to the exposure limit value are commonplace and it is important that operators understand the actions that they must take to limit their exposures. The arrangements for this will vary widely, for example they may need to observe their own trigger times for use with a points system or colour coded 'traffic light' system.

The operator should also be made aware of the consequences of excessive exposure to hand-arm vibration and how to recognize and report symptoms.

2.6 Appropriate health surveillance for HAVS

Health surveillance is more likely to be a reliable indicator of adequate control of vibration risks than is exposure assessment.

Health surveillance can be used to check the effectiveness of the control measures in preventing symptoms of HAVS. Regular checks can be used to inform susceptible individuals of the consequences of continued exposure and inform employers of weaknesses in the exposure control programme. In either case changes can be made to avoid cases of handicap.

2.7 Changes to legal duties concerning exposure to hand-arm vibration

The existing duties of employers (namely to assess, control and manage risks to employees' health from exposure to vibration, and to carry out health surveillance where the risk assessment shows it to be necessary) are only slightly modified by the Vibration Regulations. Most employers who are working to HSE's existing guidance on hand-arm should not have to do much more to comply with the Vibration Regulations. The exposure action value and exposure limit value provide clarification of existing general duties, identify the circumstances where control of exposure and health surveillance are required, and establish (through the exposure limit value) a minimum standard of protection for workers across Europe.

3 PARTICULAR ISSUES FOR WHOLE-BODY VIBRATION

3.1 Assessing risk

3.1.1 Activities where whole-body vibration is likely to be a risk

A few pointers to the likely need to manage exposure to whole-body vibration include: a history of back pain in the job; warnings of risks from whole-body vibration by the machinery manufacturer;

the presence of shocks and jolts – no matter how infrequently during the day; and obvious motion of the operator relative to the machine, vehicle, etc. or the ground.

The exposures of most drivers of road vehicles are unlikely to reach the exposure action value both because the vibration in the vehicle is likely to be low and because the period of driving in any one day is usually much less than 8 hours. However, some road vehicle drivers are likely to be exposed above the exposure action value because of a combination of frequently driving the vehicle in conditions where vibration levels are high, for example, along cobbled streets or farm tracks, and driving for most of an 8-hour shift or longer.

Most operators of off-road machinery are likely to be exposed in excess of the exposure action value.

Relatively few occupational activities are likely to result in regular exposure in excess of the exposure limit value. The most severe vibration environments are likely to be found in small fast boats. Some seasonal work in agriculture such as ground preparation and operation of some types of earth moving machinery such as scrapers are likely to result in exposures in excess of the exposure limit value unless the operations are carefully managed.

3.1.2 Setting priorities for action

A European Standard[8] provides a method of determining exposures for comparison with the exposure action and limit values of 0.5 m/s^2 A(8) and 1.15 m/s^2 A(8) respectively. These criteria take insufficient account of exposure to shock to be used for deciding control actions and setting priorities.

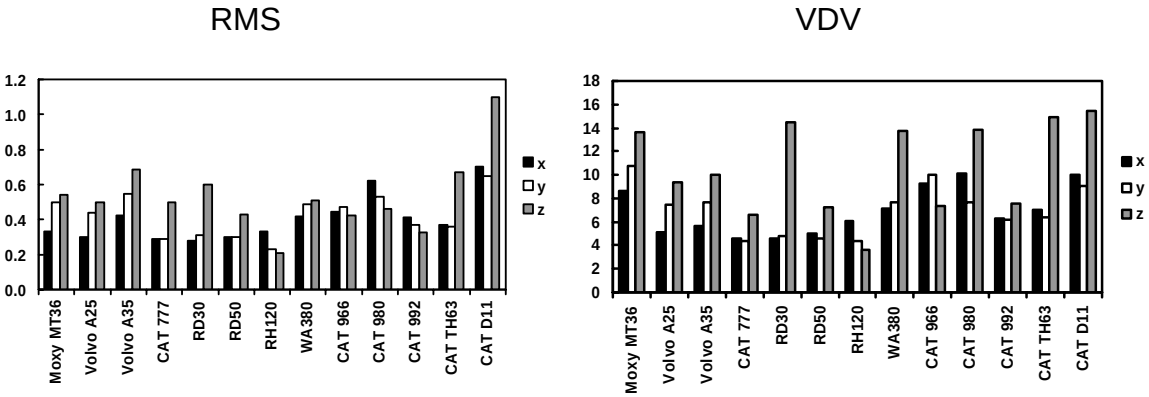

Figure 1: Changed priorities according to exposure assessment method

The Regulations require control of risks associated with exposure to whole-body vibration including risks from shocks. In practical terms there will be few exposures below the action value where risk is clearly attributable to whole-body vibration alone – exceptions will include exposure to infrequent high magnitude shocks with little or no related vibration exposure. Priorities for control action should be set according to the contribution to risk from the vibration and the shock. The Vibration Dose Value provides an integrated measure of both vibration and shock. According to International Standards[9], exposure to whole-body vibration causes risk of injury when the Vibration Dose Value exceeds 17 m/s$^{1.75}$.

An illustration of how priorities change according to analysis by root mean square acceleration and Vibration Dose Value is indicated in Figure 1. The data presented is for earth moving machinery and was gathered over a 2-hour sampling period. The factor 1.4 for the x- and y-axes is omitted but a striking difference in the relative priorities between machines and also the frequent change of

importance in z- relative to x- and y-axis vibration is clear. Similar findings have been made for machinery used in agriculture.

Other measures of exposure may further assist setting of priorities.

3.1.3 Manufacturers' data

Standards for the reporting of whole-body vibration emissions currently exist currently exist for industrial trucks and airport machinery but there is minimal work to prepare additional standards. Further, there seems to be little case for preparing Standards to help distinguish between mobile machinery on the grounds of vibration due to reports that there is little difference in the vibration emissions of directly competing machines. The value of emission data is, therefore, to assist estimation of workplace exposures to determine the applicability of the COVAW Regulations.

Members of International and European Standards Committees for earth moving machinery are currently working on a document to assist their customers assess the applicability of the Regulations to their operations. In practice, virtually all earth moving machinery operators are likely to be exposed above the exposure action value but the new document should help its readers avoid exceeding the exposure limit value.

3.1.4 HSE Information Sheets

There is a lack of whole-body vibration exposure data for many occupations. An extensive programme of measurements over the next few years is required to inform risk control priorities where exposures above the exposure action value appear likely. An early priority is to investigate those occupations where exposures may exceed the exposure limit value.

HSE is contributing to generic assessment of risk from whole-body vibration across a sample of British industry. It is intended that these assessments will be published and include identification of the classes of vehicle most likely to present a whole-body vibration hazard, the processes most likely to present risk of back pain, likely emissions by class of machinery, likely exposures by occupation, and factors other than whole-body vibration that may be important causes of back pain.

The outcome of this work will appear as information sheets from the end of 2005. These information sheets will identify good practice for high exposure industries. It should be possible for industry to introduce this good practice without recourse to further measurements.

3.2 HSE's priorities for control action

3.2.1 Training of operators

Operator technique is important in off-road whole-body vibration exposure. The operator chooses the route (determining what obstacles will be encountered) and the speed for negotiation of each obstacle (pot-hole, gully, door sill, etc.). Whole-body vibration exposure generally increases with speed but the increase is erratic and dependent upon machine and driving surface characteristics amongst other things. Some restrictions on speed and route will often be beneficial.

The correct setting of suspension seats is not straight forward. It is important that the operator understands what is to be achieved by adjusting the seat if the potential benefit is to be fully realized. Care should be taken to ensure that operators know the correct compromise between setting a seat to reduce vibration and setting it to avoid shocks from end stop impacts.

The operator should also be made aware of the consequences of excessive exposure to whole-body vibration and how to report symptoms.

3.2.2 Choice of machinery

There is frequently little to distinguish the whole-body vibration from one mobile machine from that of its direct competitors but using, for example, a smaller machine (mass, or load capacity, etc.) can increase vibration exposure and such unnecessary exposure should be avoided. However, there are a few machines that are in direct competition where the vibration emission is significantly different and it is important to spot machinery that does present a higher risk, e.g. because of failures to reduce the transmission of vibration or shocks to the driver.

3.2.3 Choice of seating

Manufacturers are obliged to fit seating that reduces the vibration transmitted to the operator to the lowest level reasonably achievable. In many machines where whole-body vibration is likely to be an issue, the manufacturer often fits a suspension seat. The current Standards for selection of suspension seating help avoid choosing an unsuitable seat but do not assure the optimum combination of seat and machine. A particular problem is that suspension seats selected and set up according to current Standards alone can impact the end stops and introduce shocks during normal use of the machine.

The seats of industrial machinery are likely to wear out several times during the life of the machine to which they are fitted. Lack of attention to the vibration characteristics of seats when they become ripe for replacement can greatly increase the transmission of vibration and shock to the occupant.

Replacement of a defective seat requires careful attention to the ergonomics of the cab as well as vibration.

3.2.4 Maintenance of machinery and roadways

Maintenance of machinery and roadways is a reliable way of assuring that exposure to whole-body vibration is minimized. Using vehicles with insufficient suspension travel for the maintained condition of pot-holed or rutted roadways is a sure way of inducing high peak vibrations. Deterioration of suspensions will increase vibration transmission to machinery occupants.

3.2.5 An holistic approach to management of back pain

HSE advises that whole-body vibration is addressed as one of many causes of back pain. Where there is evidence that whole-body vibration is causing other injuries these must also be addressed.

HSE's investigations of back pain and exposure to whole-body vibration in drivers have shown manual handling work and constrained or awkward postures to be at least as important as the exposure to whole-body vibration in many cases. HSE recommends simultaneous investigation of poor posture, anthropometrics, and manual handling work as causes of back pain whenever investigating whole-body vibration, to establish the most probable cause of back pain and set priorities for its control. If risks from manual handling work or poor posture cannot be ruled out they should be investigated in at least as much detail as risk from exposure to whole-body vibration.

It is likely that exposure to whole-body vibration will aggravate existing back injury and may give rise to complaints when the injury is not originally caused by whole-body vibration. It is also likely that whole-body vibration in combination with posture or other factors will affect susceptibility to back injury in a few occupations, e.g. crane drivers, but a scientific basis for assessment of these combined exposures is unavailable.

3.3 Health monitoring for whole-body vibration injury and back pain

Until such time as health surveillance techniques become available to detect and attribute injury to whole-body vibration exposures, HSE recommend that a lesser standard of health monitoring is

used to review the prevalence of back pain and its association with particular activities at work. Analysis of the cases of reported back pain must consider that the back pain may have been caused by aspects of the job (or non-work activities) other than exposure to whole-body vibration.

4 CONCLUSION

Employers should respond to the CAVAW Regulations by reviewing and implementing what can and should be done to reduce exposures to vibration so far as is reasonably practicable. The requirements of the new Regulations are consistent with advice given in earlier HSE guidance. A high degree of precision in exposure assessment cannot be expected, nor is it necessary, in general, to guide selection of appropriate control measures. Sharing of quality vibration data and information about good practice vibration exposure controls and using analysis of employees' health data is likely to help minimise risk of handicap and achieve compliance with the Regulations.

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