

USAR Equipment – Vibration Management

Introduction

Current legislation, specifically the *Control of Vibration at Work Regulations 2005*, specifies the need for any employee who is subjected to vibration sources to have that exposure controlled in order to keep exposure levels below pre-determined levels. Consequently, a hierarchy of controls exists:

- Eliminate the vibration source.
- Substitute the vibration source for one of a lower output.
- Engineering options to reduce the vibration output of the tools.
- Management controls to monitor and reduce exposure time of operatives to vibration sources.
- Personal protective equipment.

Whilst it is not realistic to eliminate all vibration sources within a USAR environment, measures can be taken to address other options on the hierarchy list.

Within the range of USAR equipment, there are various options of saws, drills, breakers and other equipment available to USAR Technicians. Specific data regarding their vibration outputs, although contained within the associated equipment risk assessment documents, is not readily available at the scene of operations.

Therefore, the vibration and noise management system provides USAR Technicians with an immediately available visual aid that assists them in selecting the appropriate equipment for the task. The inclusion of a logbook to record exposure levels also enables supervisory offi over sustained periods.

Vibration Exposure Levels

The Control of Vibration at Work Regulations 2005 stipulates the exposure values for both hand arm vibration and whole body vibration. There is one set of figures for hand arm vibration (HAV), formerly referred to as ‘vibration white finger’ and a second set for whole body vibration (WBV).

Personnel may be subjected to HAV whilst operating the variety of hand tools carried on the USAR modules, whilst WBV may be experienced during the operation of the multi-purpose vehicle (MPV or Bobcat), carried on USAR Module 4.

Hand Arm Vibration (HAV)

Previously referred to as ‘vibration white finger’ and encountered following the prolonged use of hand operated power tools. Daily exposure values are as follows:

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 1 of 8

- ✓ Exposure Action Value (EAV) = 2.5m/s squared.
- ✓ Exposure Limit Value (ELV) = 5.0m/s squared.

Both figures are time weighted averages over an 8 hour period.

These figures can be transposed into a points per minute type system, thus enabling USAR Technicians to record their exposure more easily. As such the EAV and ELV correspond to minimum and maximum points totals for a day:

- ✓ EAV of 2.5m/s squared = 100 points per day.
- ✓ ELV of 5.0m/s squared = 400 points per day.

Whole Body Vibration (WBV)

Encountered following prolonged use of vehicles such as the USAR Multi-Purpose Vehicle (MPV). Daily exposure values are as follows:

- ✓ Exposure Action Value (EAV) = 0.5m/s squared.
- ✓ Exposure Limit Value (ELV) = 1.15m/s squared.

Both figures are time weighted averages over an 8 hour period.

These figures can be transposed into points per hour type system, thus enabling USAR Technicians to record their exposure more easily. As such the EAV and ELV correspond to minimum and maximum points totals for a day

- ✓ EAV of 0.5m/s squared = 100 points per day.
- ✓ ELV of 1.15m/s squared = 529 points per day.

In the case of either hand arm or whole body vibration, the points ELV limit should not be exceeded as far as is practicable.

Vibration and Noise Management System

The system consists of labels and log books, which will be distributed to USAR Units:

Labels

A label for each item of equipment that emits a vibration output. These labels will be provided in individual bags corresponding to each USAR Module. The labels are colour coded dependant on the level of vibration output they emit.

- Green = Up to 2.5m/s squared.
- Amber/orange = Between 2.5m/s squared and 5.0m/s squared.
- Red = Above 5.0m/s squared.
- Yellow = Noise output only or whole body vibration label.

The label itself contains information regarding:

- The model and name of the equipment

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 2 of 8

- The vibration output in m/s squared and corresponding points per minute score (PPM)

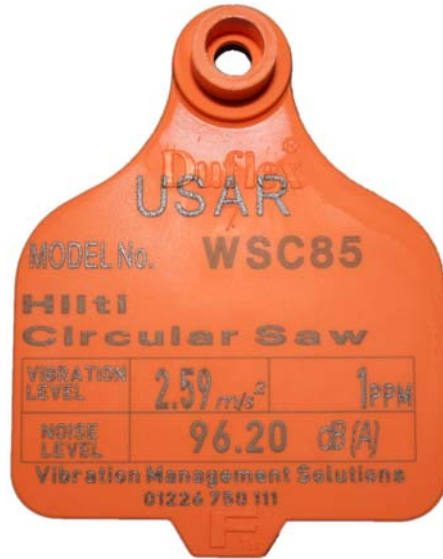


Figure 1: Vibration/Noise Label

Log Books

A log book is provided to each USAR Unit in order to allow personnel to record the time and 'score' of their vibration exposure.

Daily Vibration Log					
Operator Name	Day	Date	Sheet No.	of	
A. FIREFIGHTER	THURSDAY	28.2.08	Max Points per Day = 400		
Tool	Tool No.	Points per Minute (p)	Time used (Minutes) (m)	Total Points (pxm)	Daily Running Total
Hilti Drill	TEGA	3	12	36	36
Hilti Core Drill	00130	2	20	40	76
Stanley Breaker	BR67	13	10	130	206
Operators Signature		* Time used is "Hands on - Power on"		Total Daily Points	206

Figure 2: Vibration/Noise Log Book

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 3 of 8

List of Equipment Values

A hard copy list of all the vibration and points per minute (PPM) values for each item of equipment on the USAR modules is provided together with the labels and log books. This is to act as a reference in the event of labels becoming lost or damaged. USAR personnel can refer to the hard copy list to obtain the relevant vibration output of a particular piece of equipment. In turn, they can find this value on the table and subsequently find the points per minute value.

- In the event of a particular m/s squared value not being found on the table, the next higher value should be used.
- In the event of a PPM value being a fraction of a whole, e.g. 0.3, then **round up** to the next whole number – in this example, round up to 1.

Recording Hand Arm Exposure

The system is designed to record the exposure to hand arm vibration caused by working with the USAR equipment and works in the following manner:

- A USAR Technician selects a particular piece of equipment to carry out a particular task. For the purpose of the example a BR67 hydraulic breaker.
- The label for the BR67 is red, which immediately informs the Technician that this particular piece of equipment has a vibration output higher than 5m/s squared and consequently he/she should be looking to use this equipment for a relatively short period of time.
- The Technician uses the BR67 for 10 minutes and then returns the equipment to the equipment dump/module.
- On doing so, the logistics officer or other supervisory officer ensures that the log book is completed accordingly. In this example:
 - a. Tool = Stanley breaker
 - b. Tool no. = BR67
 - c. PPM = 13 (provided on the equipment label)
 - d. Time used = 10 minutes
 - e. Total points = 130 (13 ppm x 10 mins)
 - f. Running total = 130
- The same Technician then uses a TE6A drill for 15 minutes:
 - a. Tool = Hilti drill
 - b. Tool no. = TE6A
 - c. PPM = 3 (provided on the equipment label)
 - d. Time used = 15 minutes
 - e. Total points = 45 (3 ppm x 15 mins)
 - f. Running total = 175 (130 from BR67 use + 45 from TE6A use)

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 4 of 8

In the event that a Technician uses only hand held tools within a 24 hour period, the maximum points that Technician should be exposed to is **400**. Similarly, over the course of a week, the total points exposure should not exceed **2000**.

Recording Whole Body Exposure

When a USAR Technician operates the MPV, they will be subject to whole body vibration. To record whole body exposure, the points are recorded in the same way as hard arm exposure using the log book.

When operating the MPV, exposure to WBV is calculated as follows:

- Over smooth surfaces the points for each 15 minute period is 2.
- Over rough terrain the points for each 15 minute period is 14.

In this example an MPV operator unloads the hydraulic lifting and moving stillages from USAR Module 2, moving over a smooth surface, and takes 25 minutes to do so.

WBV exposure is 2 points for every 15 mins use of the MPV. As the operator has effectively used the vehicle for almost half an hour, the total points accrued in this example would be **4** (2 blocks x 15 minutes use). Using the same example, the recorded exposure over rough terrain would be **28** points.

Entries for the MPV would be recorded in the same manner as a piece of equipment, entering MPV in the ‘tool’ column and the registration number in the ‘tool no.’ column.

In the event that a Technician only operates the MPV within a 24 hour period, then the maximum points that Technician should be exposed to is **529**. Similarly, over the course of a week, the total points exposure should not exceed **2645**.

In the event that a Technician uses hand held tools and the MPV within the same 24 hour period, the maximum points that Technician should be exposed to is **400**. Similarly, over the course of a week, the total points exposure should not exceed **2000**.

Exceeding Daily Limits

When dealing with vibration, the two sets of relevant figures are:

Exposure Action Value (EAV)	2.5m/s sqd (HAV)	100 points per day
	0.5m/s sqd (WBV)	100 points per day
Exposure Limit Value (ELV)	5.0m/s sqd (HAV)	400 points per day
	1.15m/s sqd (WBV)	529 points per day

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 5 of 8

The Health and Safety Executive (HSE) encourage personnel to limit their exposure to vibration as much as possible. Consequently, the maximum points allowed per day in the log book is set as 100 as this is the Exposure Action Value (EAV). However, given the Exposure Limit Value (ELV) and the likelihood that USAR personnel will reach this during protracted operations, the maximum points allowed per day increases to 400.

Circumstances may arise whereby personnel exceed the 400 point daily maximum and examples of these include:

- A Technician has reached 400 points in a day during training and is then mobilised operationally. Whilst the preference would be to assign other tasks to this individual, it may not always be possible. As such, it would be reasonably acceptable for the individual to exceed 400 points, assuming that additional controls are in place to keep this additional exposure to a minimum.
- A Technician is involved in a breaching operation resulting in the location of a casualty. The Technician is aware that they are on or near their daily maximum, but to withdraw may delay the casualty extrication. As such, exceeding the limit in this instance would also be reasonably acceptable, again assuming that the Technician(s) concerned were withdrawn at the earliest opportunity.

This is not an exhaustive list, but gives a general idea of the circumstances that could give cause to personnel exceeding their daily limit. It is the responsibility of supervisory officers to avoid such circumstances as far as is reasonably practicable. Technicians must also take personal responsibility to monitor and record their own exposure levels.

If a Technician does exceed 400 points for a day (for HAV) or 529 points per day (for WBV), then this should be accounted for within the weekly totals (2000 for HAV and 2645 for WBV). The weekly totals are figures given by the HSE and are based on an average of a 5-day week. The subsequent remaining day's exposure should be reduced accordingly to ensure that the weekly limit is not exceeded. For example:

Hand Arm Vibration (HAV)

Whole Body Vibration (WBV)

Day 1 total = 400 points
 Day 2 total = 750 points
 Day 3 total = 250 points
 Day 4 total = 200 points
 Day 5 total = 400 points

Day 1 total = 529 points
 Day 2 total = 529 points
 Day 3 total = 629 points
 Day 4 total = 529 points
 Day 5 total = 429 points

Weekly total = 2000 points

Weekly total = 2645 points

Please note that for the purpose of training, exposure should be kept to a minimum. The 400 points per day maximum should not become a target and personnel should be rotated from task to task in order to reduce exposure levels.

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 6 of 8

Under no circumstances should the 400 points per day (HAV) or 529 (WBV) maximums be exceeded for training purposes.

Monthly Exposure Review

In order to satisfy review and recording criteria for the HSE, it is necessary to complete a periodic inspection of personnel’s exposure – as recorded in the log books.

Electronic Recording of Exposure

Guidance from the HSE does not stipulate how an individuals exposure to vibration should be recorded. The printed log books are supplied as the ‘standard’ option, however USAR Units may wish to record exposure using an electronic system. Examples of these systems, which have been developed by USAR Units, are included below for information only. Further information can be obtained by contacting the USAR Units directly.

The screenshot shows the 'SECTOR REGISTER' page of the SCUE Sector Management System. The page is titled 'SPECIAL OPERATIONS' and 'DEVON AND SOMERSET FIRE & RESCUE SERVICE'. The date is 'Friday, Jul 4 2008'. The page is divided into several sections: 'INCIDENT DETAILS' (with fields for start date, sector identification, commander, category, and location), 'NEW RECORD' (with fields for Ref No, Name, Organisation, and Sector Role), and 'UPDATE RECORD' (with fields for Ref No, Name, and Sector Role). There are buttons for 'ENTER DETAILS', 'REGISTER NEW RECORD', 'CLOSE', 'DELETE', 'UPDATE', 'REGISTER', 'MONITOR', and 'STATUS'.

3: Electronic Vibration Log

This screenshot is identical to the one above, showing the 'SECTOR REGISTER' page of the SCUE Sector Management System. It displays the same form fields and buttons for recording incident details, new records, and updating records.

4: Electronic Vibration Input

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Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 7 of 8

Appendix ‘A’

Aide memoirs for relevant vibration outputs and corresponding points per minute (ppm).

Hand Arm Vibration (HAV)		
	Output m/s sqd	PPM
Exposure Action Value	2.5	100
Exposure Limit Value	5.0	400
Maximum Points per Week	N/A	2000

Whole Body Vibration (WBV)		
	Output m/s sqd	PPM
Exposure Action Value	0.5	100
Exposure Limit Value	1.15	529
Maximum Points per Week	N/A	2645

Date	Status	Document Number	Version	Page
July 2008	Final	ND_USAR_SOP_HAS003	1.0	Page 8 of 8