

# Lecture 7: Controlling Vibration Hazards

**Course:** Health Safety & Environment

**Instructor:** Kashif Liaqat

**Term:** Fall 2021

BUITEMS – DEPARTMENT OF MECHANICAL  
ENGINEERING



# What is HAVS?

Hand Arm Vibration Syndrome (HAVS)

- ❖ Regular long term exposure to **hand-arm vibration (HAV)** disrupts blood circulation
  - ❖ Vascular
  - ❖ Neurological
  - ❖ Musculo-skeletal
- ❖ Painful and disabling



# Health Effects of Exposure to Vibration

- ❖ Regular and frequent exposure to hand-arm vibration can lead to two health conditions
  - ❖ Hand Arm Vibration syndrome (HAVS)and
  - ❖ Carpal Tunnel Syndrome (CTS)

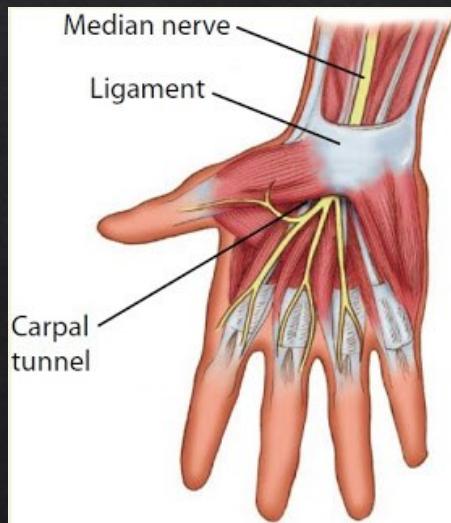


## What is Hand Arm Vibration Syndrome? HAVS

- ❖ Symptoms and effects of HAVS include
  - ❖ **tingling and numbness** in the fingers which can result in an inability to do fine work (e.g. assembling small components) or everyday tasks (e.g. fastening buttons)
  - ❖ **loss of strength in the hands** which might affect the ability to do work safely
  - ❖ the **fingers going white** (blanching) and becoming red and painful on recovery, reducing ability to work in cold or damp conditions especially outdoors

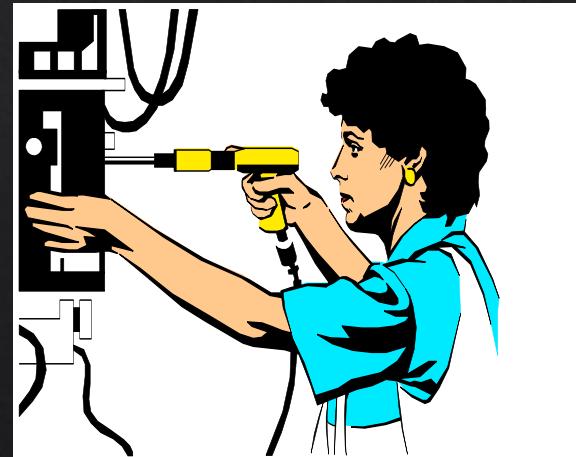
# What is Carpal Tunnel Syndrome? CTS

- ❖ Carpal tunnel syndrome is caused by compression of the **nerve that controls sensation and movement** in the hands
- ❖ The carpal tunnel is a **narrow passage in your wrist** made up of small bones and a tough band of tissue. It acts as a pulley for the tendons that bend the fingers



Symptoms of CTS include **tingling, numbness, pain and weakness** in the hand which can interfere with work and everyday tasks

# Hand and Power Tool Safety



# Risk factors: vibration

- ❖ The longer a worker undertaking manual tasks is exposed to vibration, the greater the risk of a musculoskeletal disorder
- ❖ Workers may be exposed to two types of vibration:
  - ❖ *Whole-body vibration*
  - ❖ *Hand-arm vibration*

# Types of Vibrations

- ❖ Exposure to harmful levels of vibration can increase the risk of musculoskeletal disorders and have a range of other health effects:
  
- ❖ **Whole body vibration** - occurs when a worker is in contact with a vibrating surface such as a seat or the floor in heavy vehicles or machinery, plant or equipment such as earth moving equipment.
- ❖ **Hand-arm vibration** - occurs when vibrations are transferred to the hands and/or arms either from a tool (e.g. nut runners, impact wrenches, grinders) or from steering wheels or controls in heavy machinery.

# Example of risk assessment checklist

Risk Scores						
	Exertion	Exposure	Posture	Movement	Environment	Injury Risk (sum)
Back						
Hand/ Arms						
Shoulders						
Legs						

Task Characteristics				
Score	Exertion	Exposure	Posture	Movement
+1	Low force and speed	Task performed infrequently for short periods	Comfortable postures within a normal range about neutral	Dynamic and varied movement patterns
+2	Moderate force or speed, but well within capability	Task performed regularly, but with many breaks or changes of task	Uncomfortable postures, but not approaching an extreme range of motion	Little or no movement, or repeated similar movements
+4	High force or speed, but not close to maximum	Task performed frequently, without many breaks or changes of task	Postures approaching or at an extreme range of motion	Repeated identical movement patterns
+8	Force or speed close to maximum	Task performed continuously for the majority of the shift		

Environmental Characteristics				
<b>Temperature &amp; Stress</b>				
<input type="checkbox"/>	moderate heat (+1) or extreme heat (+2)			
<input type="checkbox"/>	stress, <input type="checkbox"/> lack of control, or <input type="checkbox"/> time pressure (+1)			
<b>Whole body vibration</b>		<b>Hand/Arm vibration</b>		
<input type="checkbox"/>	moderate (+1 to back)	<input type="checkbox"/>	moderate (+1 to arms)	
<input type="checkbox"/>	high (+2)	<input type="checkbox"/>	high (+2)	

3/12/2022

9

# What does an employer need to do?

*Employers have duties to:*

- Assess
- Control
- Information, Instruction and Training
- Check

# What the Law Says

- ❖ The Control of Vibration Regulations
  - ❖ Identify and measure exposure to eliminate or reduce risk of exposure to hand arm vibration – risk assessments, tool selection
  - ❖ Make sure that the legal limits of exposure to vibration are not exceeded
  - ❖ Ensure control measure are properly applied – e.g. job rotation
  - ❖ Provide information, instruction and training to employees – briefings
  - ❖ Provide suitable health surveillance – and ensure compliance

# Control Measures

- ❖ Elimination – change the way of work so that vibrating tools are no longer used
- ❖ Substitution – replacing tools with ones with lower vibration emission
- ❖ Task Considerations – does the task need to be done manually or can it be mechanised?
- ❖ Task Rotation – within each shift make sure that individuals change the tasks that they do so that they do not breach the exposure levels (EAV or ELV)
- ❖ Monitor Individual's Vibration Exposure

# EAV and ELV explained

- ❖ **EAV Exposure Action Value 2.5m/s<sup>2</sup>**
  - ❖ The level at which **measures should be introduced to eliminate or control risk** to be as low as possible
- ❖ **ELV Exposure Limit Value 5m/s<sup>2</sup>**
  - ❖ The **level which should not be exceeded** and at which immediate action should be taken to reduce vibration exposure
  - ❖ The exposure limit value (ELV) is the **maximum amount** of vibration an employee may be exposed to **on any single day**

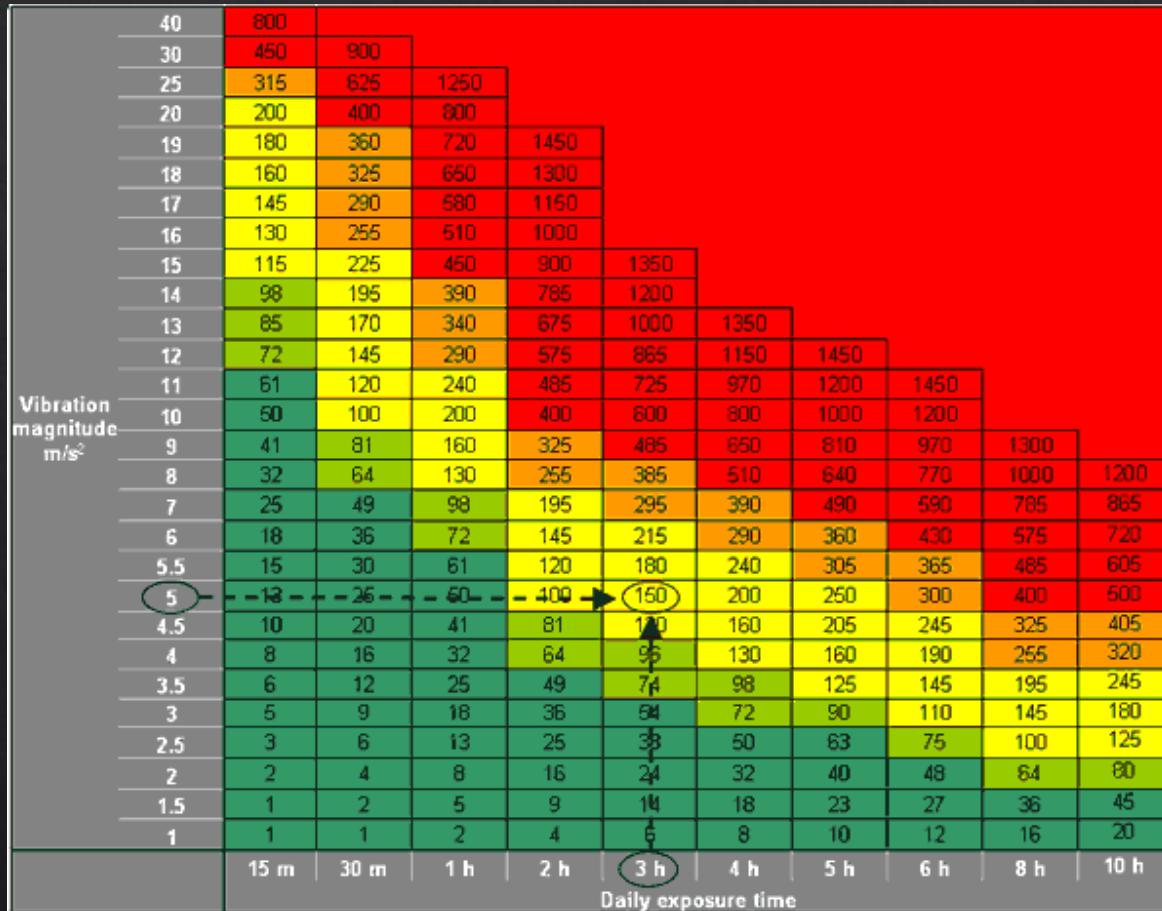
# Points System

- ❖ The points system has been devised by the Health and Safety Executive (HSE) to simplify measuring daily exposure to vibration
- ❖ The system converts the vibration ( $\text{m/s}^2$ ) into points

100 points per day = exposure action value (EAV)

400 points per day = exposure limit value (ELV)

# Points and the regulations



100 points

**Action value-**

- Reduce as far as you can
- Provide training
- Provide health surveillance

400 points

**-Limit value-**

# HAVS Data Sheet

- ❖ Found on Safety Central
- ❖ Contains vibration data on each tool
- ❖ Details how much trigger time will be needed to reach the EAV or ELV



# Monitoring Vibration Exposure

- ❖ Exposure to vibration can be measured either by
  - ❖ a paper based record completed by the employee
  - or
  - ❖ Using technology – an electronic vibration monitoring device

It is important to have an understanding of each persons exposure to be able to identify employees at risk and to control the risk

# Responsibilities

## ◆ Line Manager –

- ❖ Know which employees are at risk
- ❖ Provide information to employees
- ❖ Ensure control measures are in place
- ❖ Plan tasks to eliminate or reduce exposure
- ❖ Ensure employees take part in health surveillance
- ❖ Investigate when a new or worsening case of HAVS is identified

## Employee –

- ❖ Know how to spot early signs of HAVS
- ❖ Report any problems to their line manager
- ❖ Take part in health surveillance
- ❖ Make sure control measures are used correctly



# Mandatory Health Surveillance

- ❖ The first health surveillance check should be carried out *before* the employee starts to use vibrating tools – a guide should be to arrange the surveillance before booking training or competency sessions
  
- ❖ A further health check is needed 6 months after starting to use tools
  - then
  
- ❖ Every employee exposed to vibration on a regular basis should take part in **annual** health surveillance



# Choosing the right tool

## Availability of tools

- ❖ Is it the best tool for the job?
  - ❖ Suitability
  - ❖ Efficiency
- ❖ Is it low vibration?
- ❖ Implement purchasing / hiring policy



# Manage the exposure to HAV

## Employers need to:

estimate the vibration from the tool;

- ❖ Manufacturers' data
- ❖ Standards improving
- ❖ Look at guidance
- ❖ Trade Associations
- ❖ Internet (databases)
- ❖ Measurements (*ISO 5349*)
- ❖ Time of use

# Vibration – solutions

- ❖ Use low-vibration tools and devices that may reduce vibration (tool balancers, extension handles, vibration isolators, damping techniques)
- ❖ Adequate rest periods
- ❖ Rotate jobs
- ❖ Maintenance
- ❖ PPE



# Reproductive hazards in the workplace

# Reproductive hazards in the workplace

- ❖ Exposure to certain chemicals, radioisotopes, and biological agents may cause problems such as infertility, miscarriage, and birth defects.
- ❖ It is important for both men and women to understand the risks of reproductive hazards.

# Take Safety Training

- ❖ Make sure everyone working with a known reproductive hazard understands the risks and how to protect themselves:
  - ❖ Provide specific Safety Data Sheets and Exposure Control Plans for chemicals and biological agents.
  - ❖ Explain possible health effects and routes of exposure:
    - ❖ Skin absorption
    - ❖ Inhalation
    - ❖ Ingestion
    - ❖ Injection
- ❖ Provide and train employees in the proper use of personal protective equipment and engineering controls to prevent exposure.

*End of lecture!*