Vibration – Health Effects Fact Sheet

WHAT ARE THE HEALTH EFFECTS OF HAND-ARM VIBRATION?

Vibration induced health conditions progress slowly. In the beginning it usually starts as a pain. As the vibration exposure continues, the pain may develop into an injury or disease. Pain is the first health condition that is noticed and should be addressed in order to stop the injury.

Vibration-induced white finger (VWF) is the most common condition among the operators of hand-held vibrating tools. The symptoms of VWF are aggravated when the hands are exposed to cold.

Vibration can cause changes in tendons, muscles, bones and joints, and can affect the nervous system. Collectively, these effects are known as Hand-Arm Vibration Syndrome (HAVS). Workers affected by HAVS commonly report:

- attacks of whitening (blanching) of one or more fingers when exposed to cold
- tingling and loss of sensation in the fingers
- loss of light touch
- pain and cold sensations between periodic white finger attacks
- loss of grip strength
- bone cysts in fingers and wrists

The development of HAVS is gradual and increases in severity over time. It may take a few months to several years for the symptoms of HAVS to become clinically noticeable.

What are the symptoms of hand-arm vibration syndrome (HAVS)?

Hand-arm vibration exposure affects the blood flow (vascular effect) and causes loss of touch sensation (neurological effect) in fingers.

A common method that is used to classify VWF is the Stockholm Workshop classification scale.

Table 1
The Stockholm Workshop classification scale
for cold-induced peripheral vascular and sensorineural symptoms
(a) Vascular assessment

Stage	Grade	Description
0	(none)	No attacks
1	Mild	Occasional attacks affecting only the tips of one or more fingers

2	Moderate	Occasional attacks affecting finger tips and middle of the finger (distal and middle phalanges), and also rarely affects the parts of the finger close to the palm (proximal phalanges)
3	Severe	Frequent attacks affecting all parts of most fingers (all phalanges)
4	Very Severe	Same symptoms as in stage 3 with skin changes in the finger tips.

(b) Sensorineural assessment	
Stage	**Symptoms**
0SN	Exposed to vibration but no symptoms
1SN	Intermittent numbness, with or without tingling
2SN	Intermittent or persistent numbness, reduced sensory perception
3SN	Intermittent or persistent numbness, reduced tactile discrimination and/or manipulative dexterity

The severity of hand-arm vibration syndrome depends on several other factors, such as the characteristics of vibration exposure, work practice, personal history and habits. Table 2 summarizes these factors.

Table 2
Factors that influence the effect of vibration on the hand

Physical Factors	Biodynamic Factors	Individual Factors
Acceleration of vibration	Grip forces – how hard the worker grasps the vibrating equipment	Operator’s control of tool
Frequency of vibration	Surface area, location, and mass of parts of the hand in contact with the source of vibration	Ability to change or vary the work rate of the machine
Duration of exposure each workday	Hardness of the material being contacted by the hand-held tools, for example metal in grinding and chipping	Skill and productivity
Years of employment involving vibration exposure	Position of the hand and arm relative to the body	Individual susceptibility to vibration
State of tool maintenance	Texture of handle-soft and compliant versus rigid material	Smoking and use of drugs.Exposure to other physical and chemical agents.
Protective practices and equipment including gloves, boots, work-rest periods.	Medical history of injury to fingers and hands, particularly frostbite	Disease or prior injury to the fingers or hands

Is Raynaud’s phenomenon of occupational origin?

Hand-arm vibration syndrome is also known as Raynaud's phenomenon of occupational origin. Vibration is just one cause of Raynaud's phenomenon. Other causes are connective tissue diseases, tissue injury, diseases of the blood vessels in the fingers, exposure to vinyl chloride, and the use of certain drugs. The resulting reduced blood flow can produce white fingers in cold environments.

What are the health effects of whole-body vibration?

Whole-body vibration can cause fatigue, stomach problems, headache, loss of balance and "shakiness" shortly after or during exposure. The symptoms are similar to those that many people experience after a long car or boat trip. After daily exposure over a number of years, whole-body vibration can affect the entire body and result in a number of health disorders. Studies of bus and truck drivers found that occupational exposure to whole-body vibration could have contributed to a number of circulatory, bowel, respiratory, muscular and back disorders. The combined effects of body posture, postural fatigue, dietary habits and whole-body vibration are the possible causes for these disorders.

Many studies have reported decreased performance in workers exposed to whole-body vibration.

How much vibration exposure has to accumulate before people are affected?

As in all occupational exposures, individual sensitivity to vibration varies from person to person.

Three important factors affect the health effects that can result from exposure to vibration:

- the threshold value or the amount of vibration exposure that results in no adverse health effects
- the dose-response relationship (how the severity of the ill health effects is related to the amount of exposure)
- latent period (time from first exposure to appearance of symptoms)

The threshold value of vibration is the level below which there is no risk of vibration syndrome. In other words, it is the maximum intensity of vibration to which most healthy workers can be exposed every workday for their entire full-time employment without developing numbness, paleness or chill of fingers. Workers will not be likely to develop vibration-related injuries or disease if their exposure to vibration is maintained at sufficiently low levels.

What has been observed is that the number of affected people increases as the intensity and duration of vibration exposure increases. This type of exposure-response relationship indicates a possible link between health effects and the total amount of vibration energy entering the hands or body. Depending on the intensity of exposure, the symptoms may appear months or years after the start of the exposure.

Are there any studies about the combined effect of noise and vibration?

Since most vibrating machines and tools produce noise, a vibration-exposed worker is likely to be exposed to noise at the same time. Studies of hearing loss revealed that, for equal noise exposure, those with vibration-induced white finger (VWF) had greater hearing loss than those without VWF. The reason for this effect is not clear.

Are there laws regarding vibration exposure at work?

Canada, British Columbia, Saskatchewan, Manitoba, Quebec, New Brunswick, Yukon, Northwest Territories, and Nunavut are the jurisdictions in Canada that have specifically mentioned vibration exposure within their occupational health and safety regulations in terms of worker health or musculoskeletal effects. Most jurisdictions do not regulate a specific limit to exposure, but rather state that workplaces must

control for vibration where it can cause health or musculoskeletal effects.

The American Conference of Governmental Industrial Hygienists (ACGIH) has published exposure recommendations for prevention of hand-arm and whole body vibration.