

E. Vibration

Vibration :- refers to back- and- forth, up-and-down, side-to-side linear motion that emanates from and returns to some defined reference position.

1. Hand-Arm vibration (HAV)
2. Whole-body vibration (WBV)

Hand-Arm vibration (HAV)

Hand-Arm vibration (HAV) , or segmental vibration, unlike Whole-Body vibration (WBV), appears as locally applied cumulative trauma to the fingers and hands of exposed workers using gasoline powered, pneumatic, or electrical hand tools such as chain saws, chipping hammers, grinders, jack-leg drills, etc.

Extensive use of such tools (especially in cold environment) has been usually linked to Raynaud's phenomenon of occupational origin, also variously called "dead hand" or "vibration white fingers" (VWF) and most recently termed hand-arm vibration syndrome (HAVS). The condition is characterized by tingling, numbness, and blanching of the fingers with probable loss of muscle control and reduction of sensitivity to heat and cold with accompanying pain on return the circulation.

Vibrating tools may give rise to injury to soft tissue of the hands and cause pain in joints of the arms, most commonly the elbows and wrists. Workers using pneumatic tools and chain saws are commonly found to have small cysts and vacuoles and osteoporotic changes in the bones of the wrist on the x-rays examination.

Vibration induced white finger (VWF) takes several years to develop as a rule and is commonly preceded by tingling and numbness in the fingers. Blanching is first noticed in one or two fingers in the winter but as the condition progresses, all the fingers become involved and episodes of blanching occur both in winter and summer. The condition can be arbitrarily divided into a number of stages for descriptive purposes.

It is important that primary Raynaud's disease, as originally described by the French physician Maurice Raynaud in 1862 in his MD thesis "local asphyxia and symmetrical gangrene of the extremities" the persons who are ordinary females the determining cause is cold the primary Raynaud's disease must be distinguished from secondary Raynaud's phenomenon

Secondary Raynaud's phenomenon may arise from:-

1. exposure to vibration
2. trauma, such as lacerations and fractures of the fingers and hands
3. frostbite
4. occlusive vascular disease, such as arteriosclerosis
5. intoxication, as from ergot or nicotine

6. neurogenic causes such poliomyelitis
7. reduced blood flow to the fingers from compression of the main blood vessels at the outlet of the thorax (e.g, cervical rib or "thoracic outlet" syndrome
8. connective tissue disorders, such as scleroderma, polyarteritis nodosa, and rheumatoid arthritis

Hand-Arm vibration control

1. first line of control is better tool design (tool redesign) that incorporates the engineering principles of vibration damping and isolation together with good ergonomic design. Currently there are many reduced vibration [or so-called antivibration (A/V) gasoline powered chain saws and related forestry and professional landscaping tools available.
2. second line control is A/v gloves, with use special viscoelastic materials to damp a broad spectrum of vibration. These gloves are also intended to keep the hands warm and dry and prevent cuts and laceration
3. third line of control is hand-arm vibration standards, of which there are in use in the United States (ACGIH-TLV, ANSI S3.34,NIOSH HAVS criteria document 89-106) Although all of these standards try to protect workers from the harmful effects of hand-arm vibration , these standards emphasize (weight) the lower vibration frequencies more than the high-frequency spectral components (51-53). As a result, some of these standards are in the process of being revised accordingly.
4. fourth and final line of control is work practices and medical surveillance.
 - i. Any worker whose hands may be exposed to vibratory hand tools should, prior to employment, be physically examined and questioned about:
 - a. Signs and symptoms of primary Raynaud's disease or Raynaud's phenomenon.
 - b. Detailed history of vibration exposure (which should be recorded); on the basis of present medical evidence, it is not advisable to allow workers with primary Raynaud's disease to use vibratory hand tools.
 - ii. A/V tools should be used when and where possible; all tools should be carefully maintained according to manufacturer's recommendation. Wor-out tools should be discarded and replaced with new ones preferably A/V tools,
 - iii. Workers are advised as follows :
 - a. Use only full-finger A/v gloves at all times when using vibrating hand-tools. A/V gloves with fingertip material removed expose the fingertips to vibration and thus do not adequately protect the finger-hand system despite the fact that finger dexterity is improved.
 - b. Wear adequate clothing to keep the body core temperature at a stable, acceptable level.
 - c. Keep the hands warm before and during work.
 - d. Do not allow the hands to become wet and chilled. Should this happen, dry and warm the hands and put on a pair of dry, warm A/V gloves.
 - e. Do not smoke while using vibrating hand tools. Nicotine act as a vasoconstrictor, reducing the blood supply to the finger and hands.

- f. Let the tool do the work, grasping it as light as it is safe to do so, allowing the tool to rest on the work piece where and when possible.
 - g. Use the ergonomically designed A/V tools where and when possible.
 - h. Use the tools only when absolutely necessary, operating at reduced speed when possible.
 - i. Should signs of tingling, numbness, or white or blue finger occur, see a physician promptly.
- iv. The hazards of HAVS can be reduced if continuous vibration exposure over long periods is avoided. Therefore a 10-minutes vibration-free rest break for every hour of continuous vibration exposure is recommended.

Whole-Body Vibration (WBV)

Epidemiology and laboratory studies have shown that WBV is a form of cumulative trauma, it can be regarded as a generalized stressor and may affect multiple body parts and organs, depending on the vibration stimuli characteristics. Thus vibration exposure time, direction and intensity are important, and the human resonance.

1. Oxygen and pulmonary ventilation increase.
2. Bone changes involving spine deformities, intervertebral osteochondrosis and calcification of intervertebral disks.
3. hypoglycemia, hypocholesteremia, and low blood ascorbic acid.
4. In an early study of agricultural and forestry workers, a rare clinical description of so called WBV sickness found;
 - a. The first stage is marked by epigastralgia, distention, nausea, loss of weight, drop in visual acuity, insomnia, disorders of labyrinth, colonic cramps, ect.
 - b. The second stage is marked by more intense pain concentrated in the muscular and osteoarticular systems.

Most whole-body vibration researchers would agree that hard tissue (mostly lumbar) spinal disorders are most frequently reported disorders.

Whole-body vibration control

1. Do not remain on a vibrating surface any longer than absolutely necessary.
2. If possible, locate machine controls remotely, a short distance from the vibrating surface.
3. In the case of vehicles, use vibrating-isolated suspended or air-ride seats. Mechanically isolate other vibrating sources from workers.
4. Carefully maintain vibration sources to prevent excessive vibration from developing.
5. Do not lift objects immediately after emerging from a vehicle after a lengthy ride, rather, first walk around for a few minutes.

