# MAIN PRINCIPLES AND METHODS OF DEFENSE AGAINST HAZARD IMPACT AND HARMFUL AGENTS.

Topic 1.5

# Outline

- Illumination
- Vibration
- Vibration sickness
- Noise
- Electric current

# Illumination

- Is one of the main parameter of hygienic characteristic.
- Luxmeter, (lx)
- Vision adaptation. This term describes the processes by which the visual system alters its properties in response to changes in the environment, e.g. in response to change of brightening
- Dark adaptation takes about 5-6 minutes, full adaptation from light to darkness, however, is longer and takes 30 minutes. light adaptation of eyes takes about 2 minutes.
- Stroboscope effect  is an
optical illusion of apparent motion or absence of motion of object. Stroboscope effect occurs when  flashing light source illuminates a moving object. This effect, created by the flickering, it is harmful to the vision and causes discomfort, visual fatigue and headaches.

# Common Light Levels Outdoors from Natural Sources

Common light levels outdoor at day and night can be found in the table below:

| Condition Illumination | Lux |
|---|---|
| Sunlight | 100 000 |
| Overcast day | 1.075 |
| Deep Twilight | 1.08 |
| Full moon | 0.1 |
| Starlight | 0.001 |

# Illumination

- Natural illumination
- Artificial illumination
- Mixed illumination. Additional lighting equipment is often necessary to compensate the low levels of light.
- Earlier it was common with light levels in the range 100 - 300 lux for normal activities. Today the light level is more common in the range 500 - 1000 lux - depending on activity. For precision and detailed works, the light level may even approach 1500 - 2000 lux.

# Recommended light level in different workspaces

| **Activity** | **Lux** |
|---|---|
| Easy Office Work, Classes | 250 |
| Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories | 500 |
| Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres | 1,000 |
| Detailed Drawing Work, Very Detailed Mechanical Works | 1500 - 2000 |

# Vibration

- Is s the oscillatory motion of objects.
- Vibration, in the general sense, occurs as periodic oscillation, as random motion, or as transient motion, the latter more normally being referred to as shock when the transient is large in amplitude and brief in duration.
- Vibration:

-Transport vibration

-Technological vibration

-Outer vibration

# Vibration sickness

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.

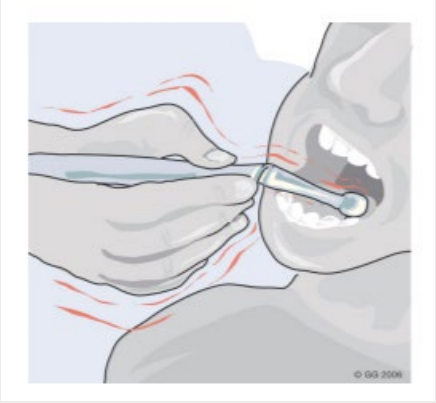
# Occupational exposure to vibration

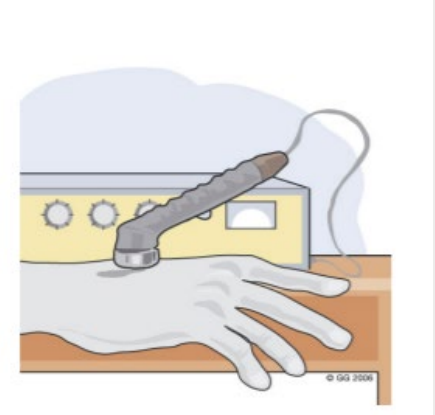
Hand-arm vibration (HAV)

Whole-Body vibration (WBV)

# Examples of a HAV exposure

- Chain saw
- Straight grinder
- Dental High-Speed Drill
- Ultrasonic Therapy Device





# Hand-arm vibration

- long term exposure from using hand held tools, causes a range of conditions and diseases, including:
- White finger (also known as "dead finger" ) - damage to hands causing whiteness and pain in the fingers;
- Carpel tunnel syndrome (and other symptoms similar to occupational overuse syndrome);
- Sensory nerve damage;
- Muscle and joint damage in the hands and arms

# WHOLE BODY VIBRATION (WBV)

- caused by poorly designed or poorly maintained vehicles, platforms,

health effects of WBV:

- Lower back pain (damage to vertebrae and discs, ligaments loosened from shaking)
- Motion sickness
- Bone damage
- Varicose veins/heart conditions (variation in blood pressure from vibration);
- Stomach and digestive conditions;
- respiratory, endocrine and metabolic changes;
- impairment of vision;
- reproductive organ damage.
- The longer a worker is exposed to WBV, the greater the risk of health effects and muscular disorders.

# Noise

- unwanted or excessive sound that can have deleterious effects on human health
- In physics, **sound** is a vibration that typically propagates as an audible wave of pressure, through a transmission medium such as a gas, liquid or solid.
- Humans can only hear sound waves as distinct pitches when the frequency lies between about 20 Hz and 20 kHz. Sound waves above 20 kHz are known as ultrasound and are not perceptible by humans. Sound waves below 20 Hz are known as infrasound.
- Noise is measured in Decibel (dB). The average noise level of 50 dB allowed for residential areas by WHO, sounds between 120 dB and 140 dB causing pain (pain threshold).

# Electric current

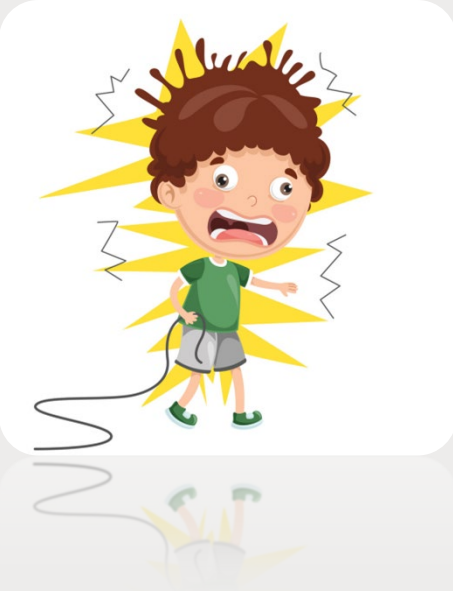
- Electric current is electric charge in motion. It can take the form of a sudden discharge of static electricity, such as a lightning bolt or a spark between your finger and a ground light switch plate.
- More commonly, though, when we speak of electric current, we mean the more controlled form of electricity from generators, batteries, solar cells or fuel cells.

# Effects of electric current on the human body

**Electrical injury** is a physiological reaction caused by electric current passing through the body.

- The human body is a good conductor of electricity. This means that electric current can easily travel through it. When current travels through someone's body accidentally, this is known as an electric shock or **electrocution**.
- Classification of electric injuries generally focus on the power source (lightning or electricity), voltage (high or low) and type of current (**alternating or direct**)
- Electric current is capable of producing deep and severe burns in the body.
- *Tetanus* is the condition where muscles involuntarily contract due to the passage of external electric current through the body.
- Diaphragm and heart muscles are similarly affected by electric current. Even currents too small to induce tetanus can be strong enough to interfere with the heart's pacemaker neurons, causing the heart to flutter instead of strongly beat.
- Direct current (DC) is more likely to cause muscle tetanus than alternating current (AC), making DC more likely to "freeze" a victim in a shock scenario. However, AC is more likely to cause a victim's heart to fibrillate, which is a more dangerous condition for the victim after the shocking current has been halted.

# First aid in the case of electric shock



The danger from an electrical shock depends on the type of current, how high the voltage is, how the current traveled through the body, the person's overall health and how quickly the person is treated.
An electrical shock may cause burns, or it may leave no visible mark on the skin. In either case, an electrical current passing through the body can cause internal damage, cardiac arrest or other injury. Under certain circumstances, even a small amount of electricity can be fatal.

1. Don't touch the injured person if he or she is still in contact with the electrical current
2. **Turn off the source of electricity, if possible. If not, move the source away from you and the person, using a dry, nonconducting object made of cardboard, plastic or wood. Don’t touch the exposed skin of victim.**
3. Begin CPR if the person shows no signs of circulation, such as breathing, coughing or movement.

# First aid in the case of electric shock. **It's important to separate the person from current's source.**

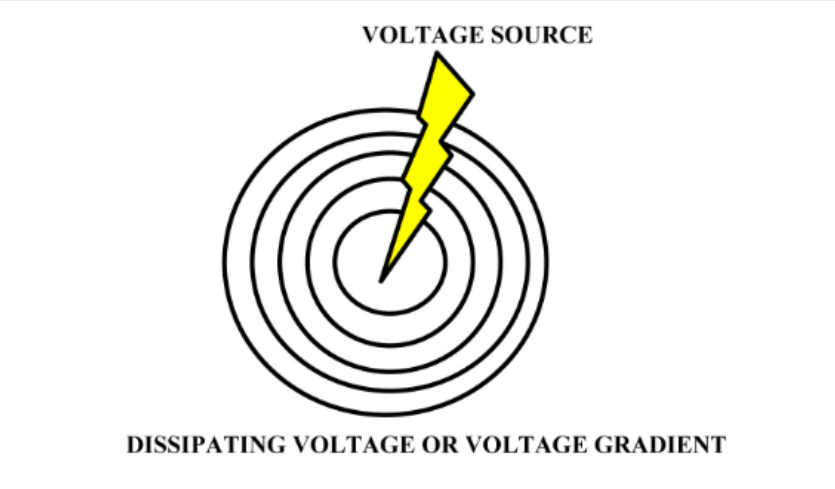
- To turn off power:

- unplug an appliance if plug is undamaged or shut off power via circuit breaker, fuse box, or outside switch.

- If you can't turn off power:

- stand on something dry and non-conductive, such as dry newspapers, telephone book, or wooden board.

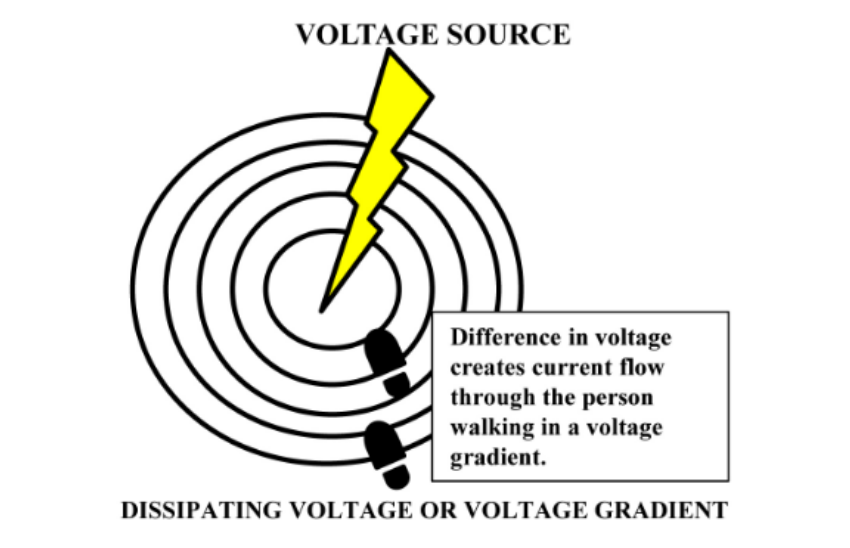
- try to separate the person from current using non-conductive object such as wooden or plastic broom handle, chair, or rubber doormat.




# What is Step and Touch Potential?

To understand step and touch potential, we first need to understand how energy dissipates across conductive objects. When an energized conductor falls across a chain-link fence or directly to the ground, the object and immediate area become energized, creating a zone of high voltage in relation to the ground. The actual voltage depends on the source, resistance of the object and soil conditions, which include material and moisture.

The voltage decreases rapidly with increasing distance from the grounded end.




# Step Potential

There is a potential difference between two points on the energized area. This is called a step potential as it can cause voltage difference between a person's feet.

# Touch Potential

Touch potential is the voltage between any two points on a person's body – hand to hand, shoulder to back, elbow to hip, hand to foot and so on. For example, if an overhead conductor falls on a car, and a person touches that car, current could pass from the energized car through the person to the ground.

# How to Protect Yourself

Electricity can spread outward through the ground in a circular shape from the point of contact.

As you move away from the center, large differences in voltages can be created.

To minimize the path of electric current and avoid electrical shock, shuffle away in small steps or hop along from the dissipating voltage area.

# THANK YOU FOR YOUR ATTENTION

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