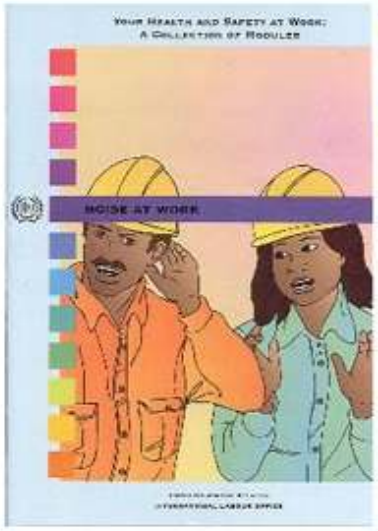
Occupational Health III.



Your health and safety at work

NOISE AT WORK

International Labour Organization

SU Department of Public Health

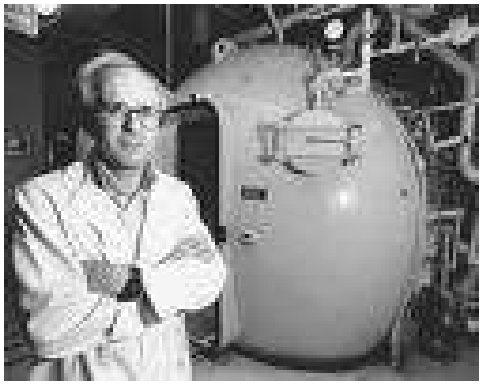
Total work
accident in Hungary

Total **work accident death** in Hungary

(Comparing: from
Traffic accident
in a year about
1000 deaths)

Decompression sickness is a condition that occurs when divers or workers from the caisson **come back to the surface too quickly** after being in deep.
It is caused by the **formation of nitrogen bubbles in the blood stream** and, in the worst cases, can cause death.
Treatment involves reversing the conditions under which it first occurred. A person is placed into a **hyperbaric (high pressure) chamber**. Pressure is increased in the chamber, **causing nitrogen gas bubbles to go back**.



Signs and Symptoms of The Bends (Develop 15 min. to 12 hrs. after surfacing)

Extreme Fatigue
Pain in Joints
Muscle Pain
Dizziness
Paralysis
Rash on Skin
Staggering
Choking
Decreased Sensation
Collapse or Unconsciousness

Vibration

Frequency:	Effect:
0 - 0.5 Hz	Kinetosis
0.5 – 16 Hz	Vibration
16 – 8000 Hz	Vibration and sound effects simultaneously
8000-20 000Hz	Sound effects
over 20 000 Hz	Ultrasound effects

Local effects

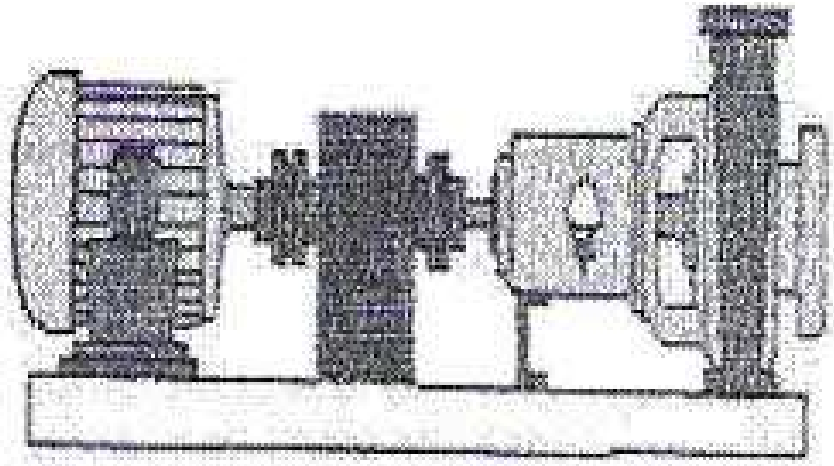
Headache, dizziness
Bone cysts, osteoporotic changes (wrist, elbow, shoulder)
Nerve lesions (plexus brachialis, n.ulnaris, n.radialis)
Raynaud phenomenon

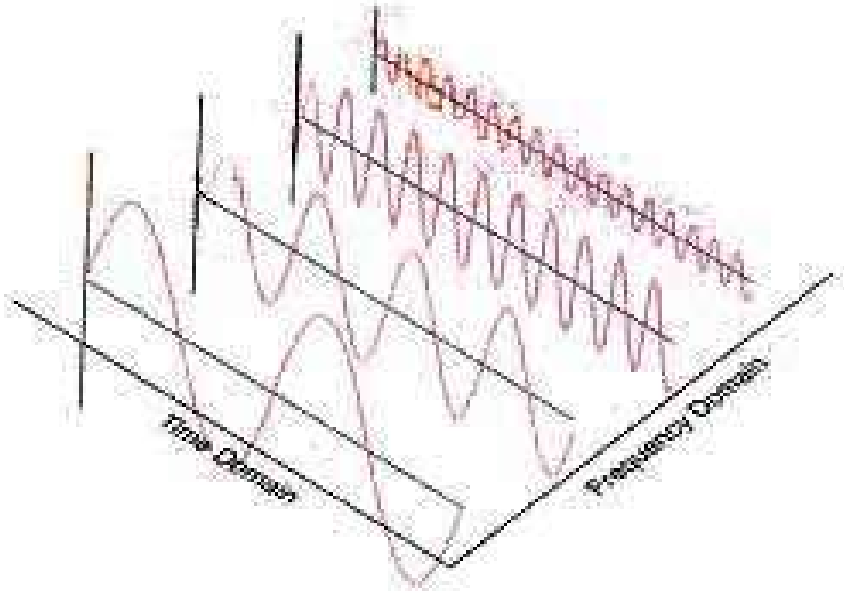
Global effects (5-11Hz)

Back pain, visceral ptosis, risk for abortion

Hand-arm vibration is caused by many power tools, such as those used in road maintenance, construction, mining and forestry, and can cause disorders such as vibration-white finger.

Whole-body vibration occurs in drivers of off-road machines, passenger and freight transport, in agriculture and aircraft.
The most commonly reported health effect from whole-body vibration is back-pain.





Vibration Analysis

Measuring instruments for vibration

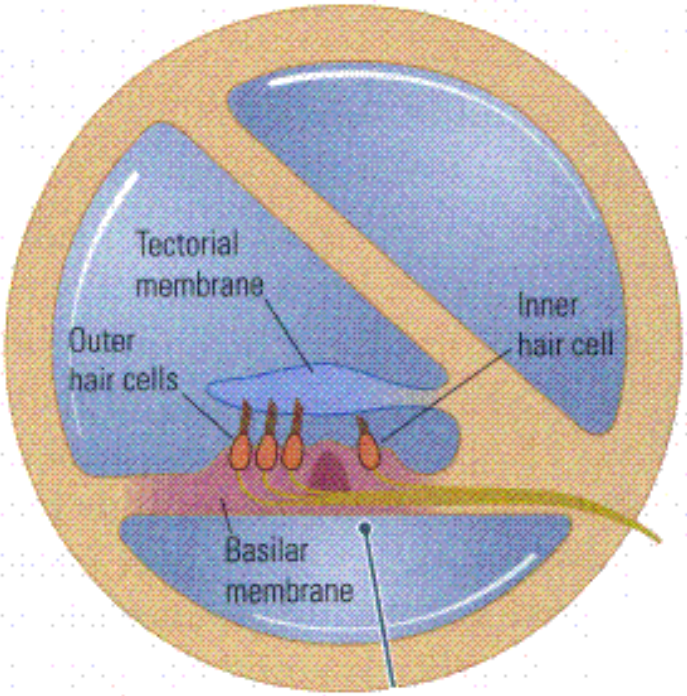
Vibration - prevention

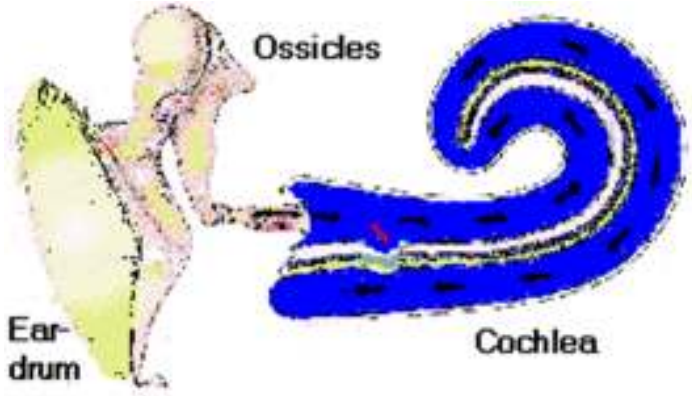
Use anti-vibration equipment

Appropriate maintenance of vibrating tools

Reduction of exposure time

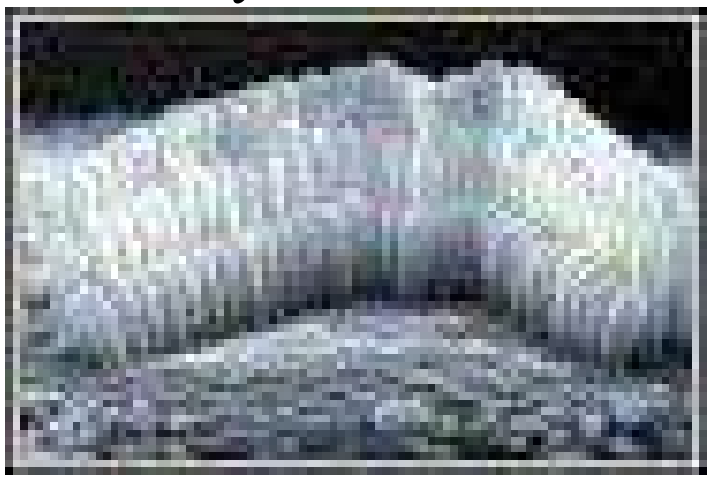
Noise



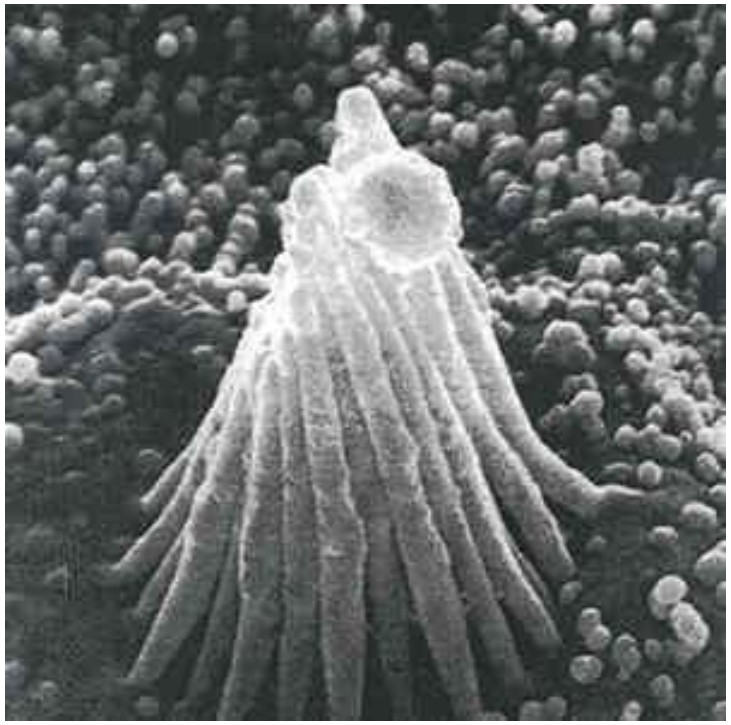


The organ of Corti in the cochlea picks up the vibrations from the basilar membrane by means of **hair cells**: mechanosensor array.

A hair cell

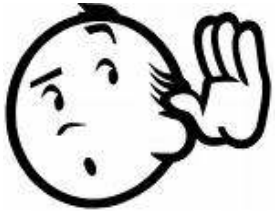


Hair cells

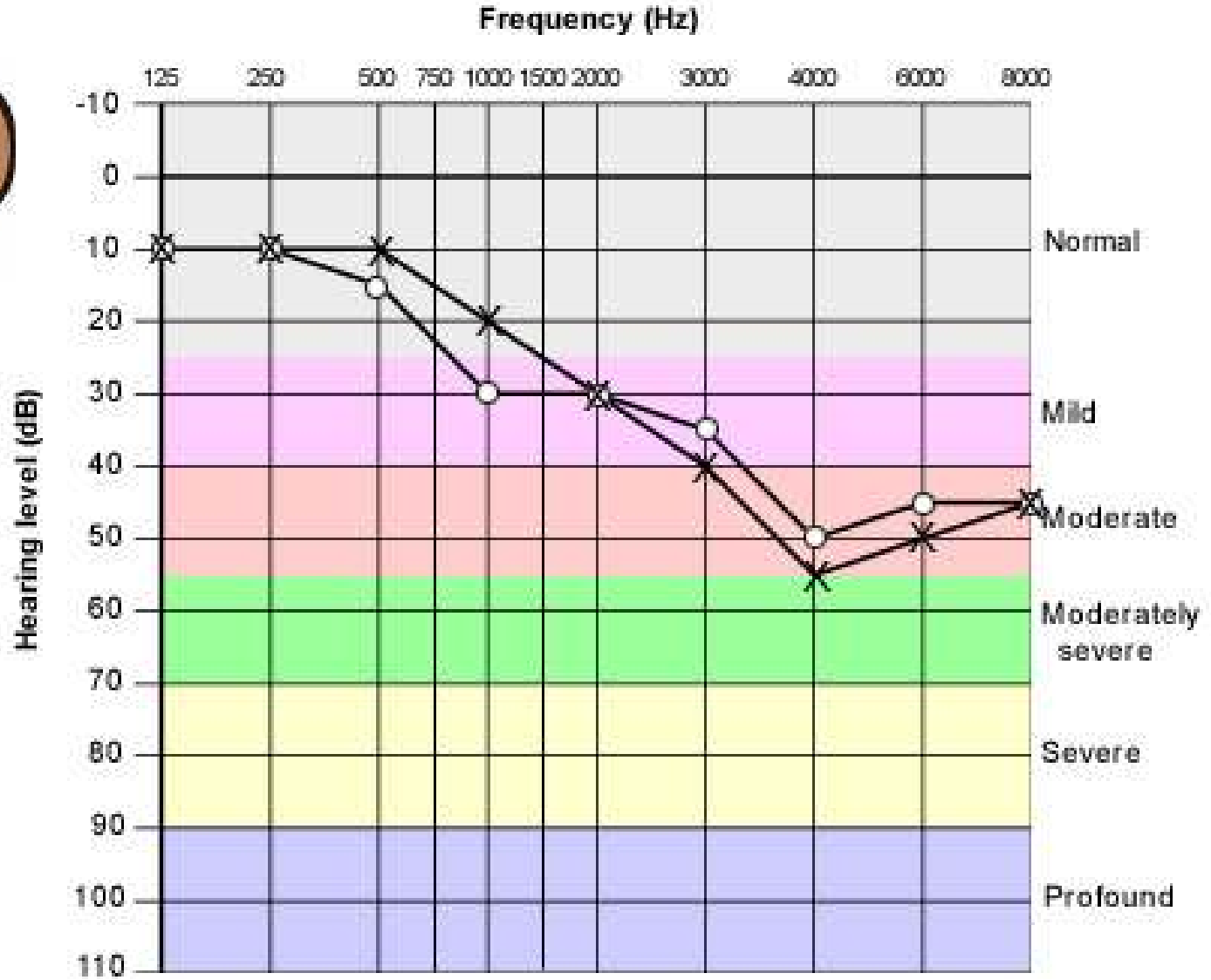


The basic mechanism of hearing involves **converting sound waves hitting the ear drum to structure-borne vibrations** transmitting through bones in the middle ear.

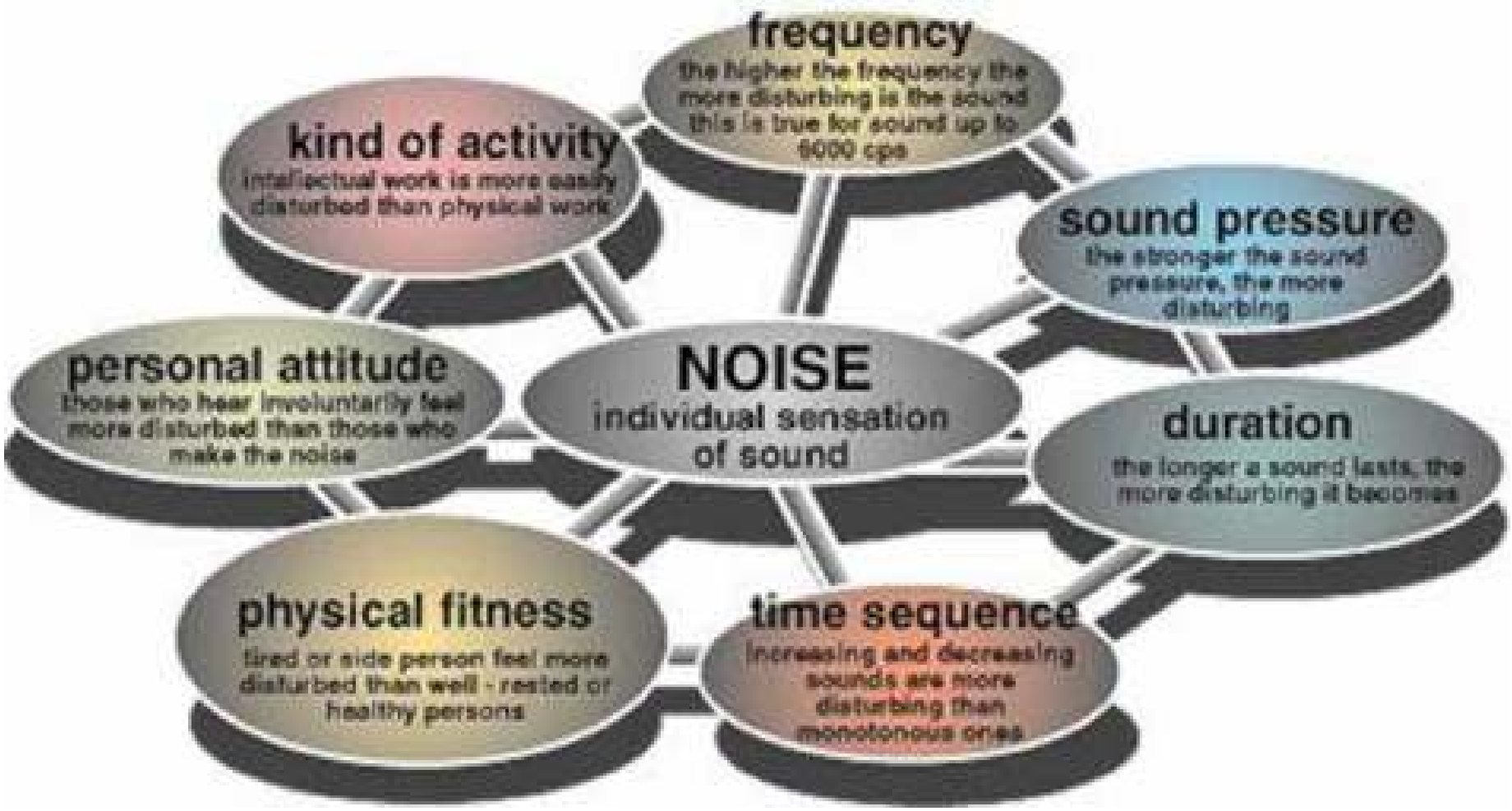
The fluid filled cochlea contains 40,000 **tiny hair cells** like the one shown at right (magnified) **that initiate the nerve impulse** which is transmitted to the brain.



With **repeated exposure** to excessive noise, **<u>these hair cells lose some of their resilience</u>** and may even break off resulting in sensorineural or noise induced hearing loss.



The area below the curves represents sound levels that the patient could still hear. (X = left ear; O = right ear)


frequency
the higher the frequency the more disturbing is the sound this is true for sound up to 8000 cps
kind of activity
intellectual work is more easily disturbed than physical work
sound pressure
the stronger the sound pressure, the more disturbing
personal attitude
those who hear involuntarily feel more disturbed than those who make the noise
NOISE
individual sensation of sound
duration
the longer a sound lasts, the more disturbing it becomes
physical fitness
tired or sick person feel more disturbed than well - rested or healthy persons
time sequence
increasing and decreasing sounds are more disturbing than monotonous ones

Injuries due to noise:

Probably the most common occupational disease.

Factors determining injury: sound pressure, frequency, exposure duration.

40-65 dB: irritation, annoyance, sleep disturbance

65-75 dB: autonomic symptoms, headaches

over 80 dB: auditory damage

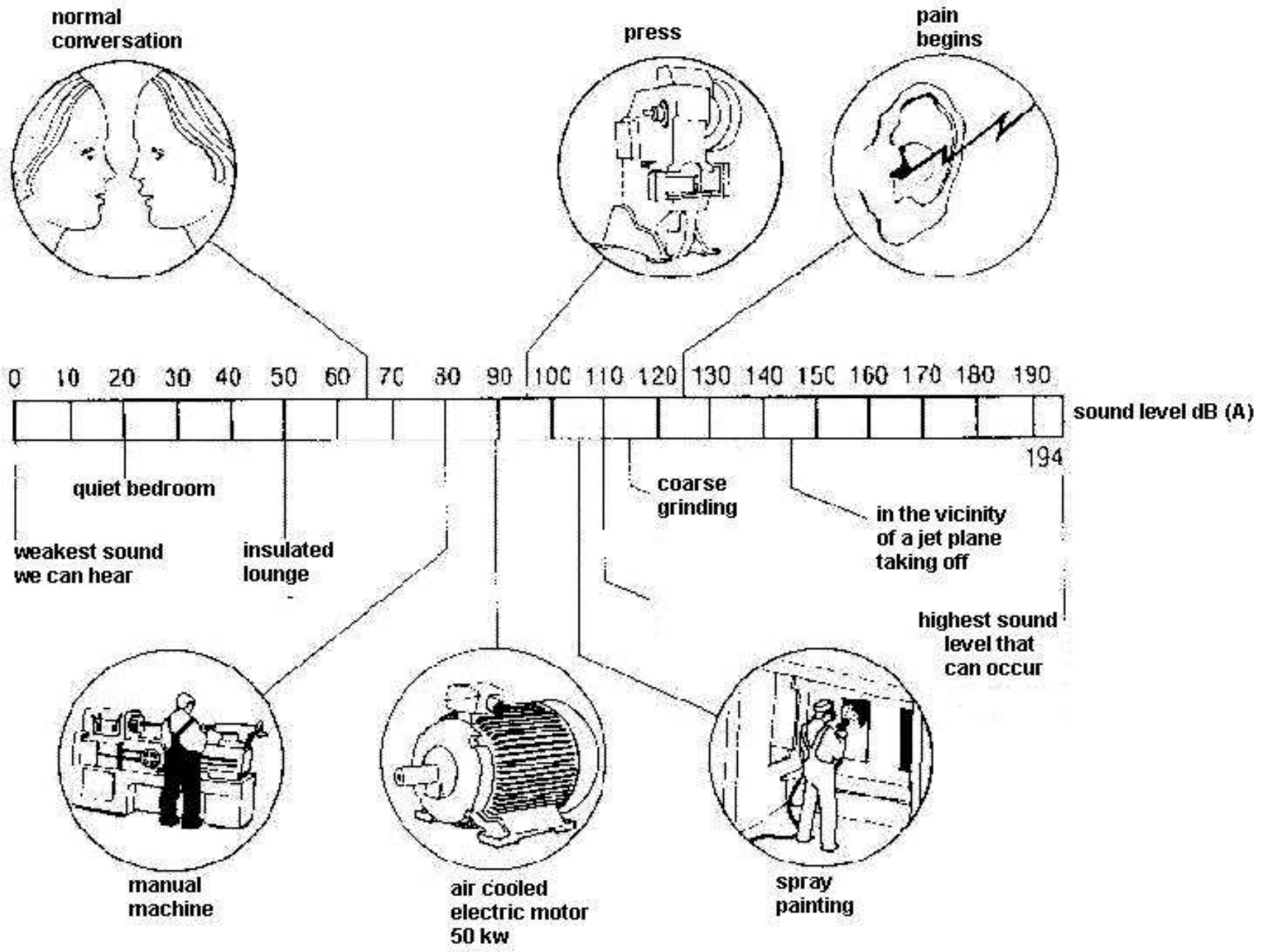
(80-100 dB - temporary, over 120 dB - permanent and/or generalised)

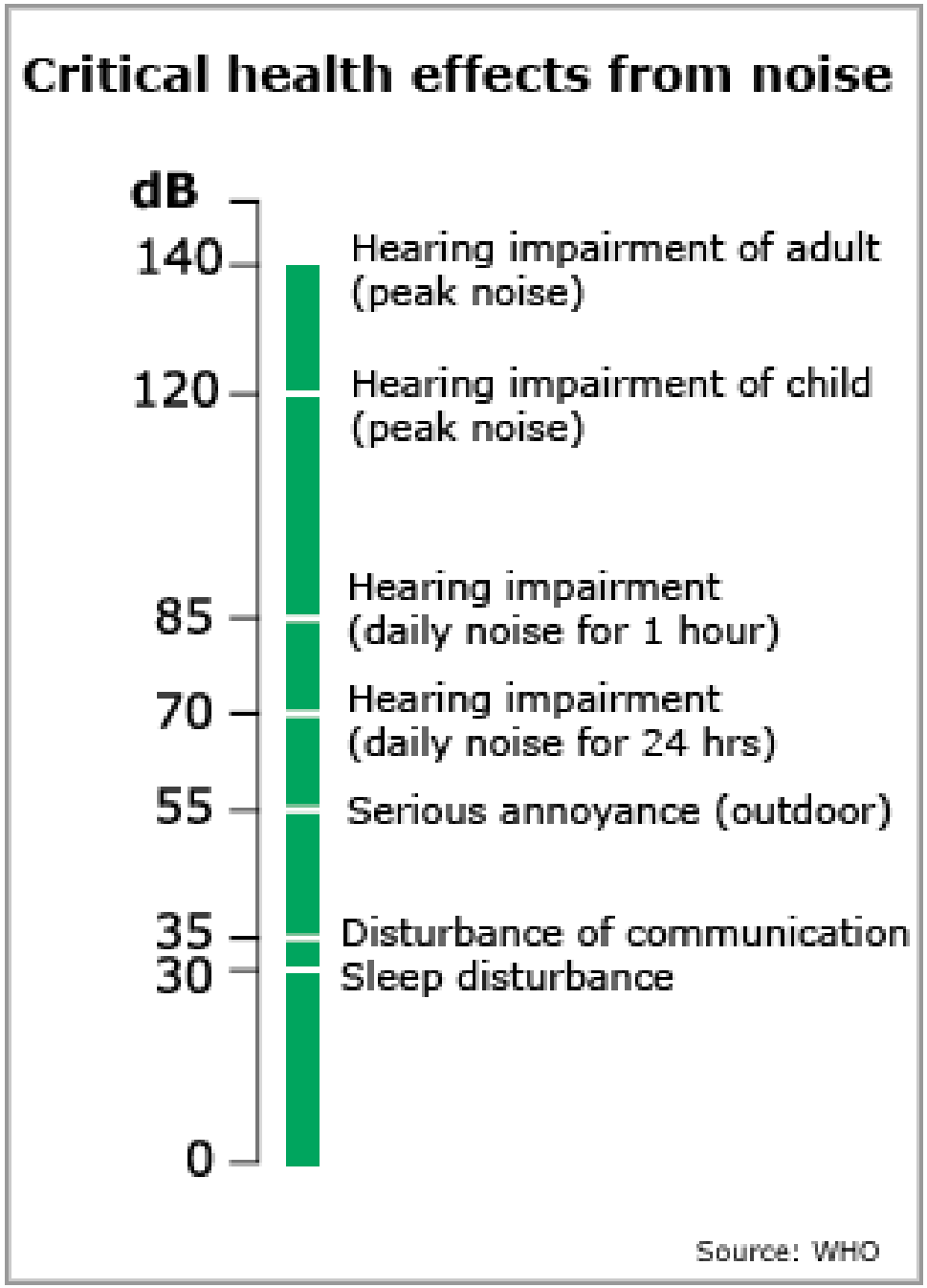
In the very early stages of hearing loss, a threshold shift first manifests itself around 4000Hz (high-pitch tones).

TTS = temporary threshold shift

PTS = permanent threshold shift

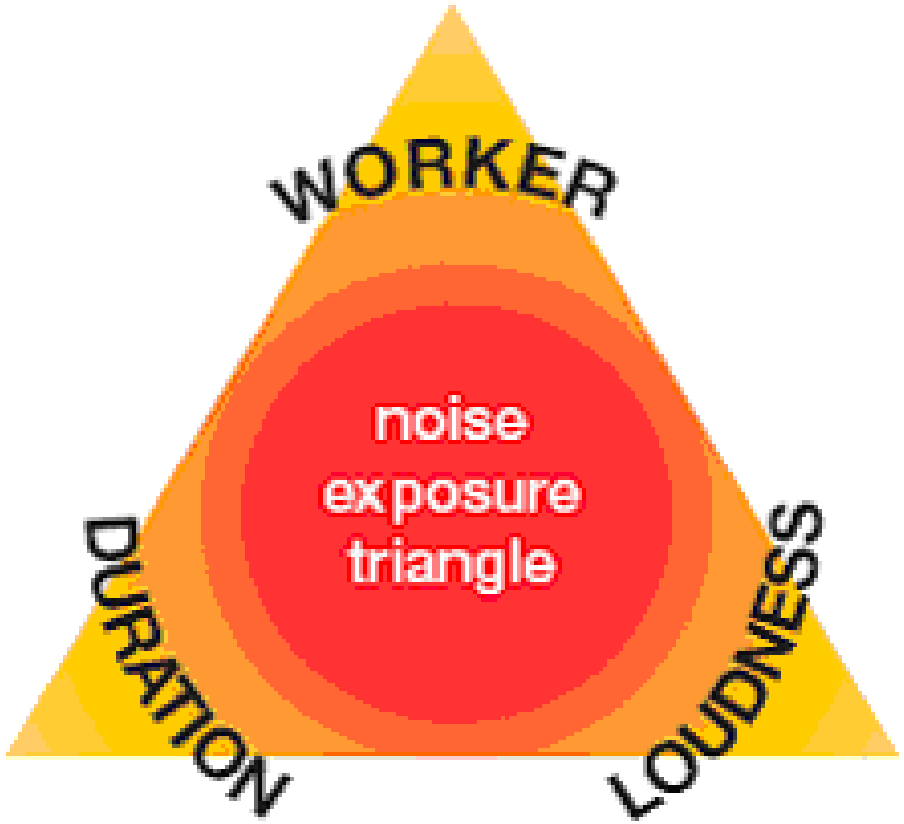
Prevention requires many different levels of intervention depending on specific situation - regular audiometric screening, technological noise reduction, individual protective gear (ear muffs, ear plugs...).


normal conversation
press
pain begins
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
sound level dB (A)
194
quiet bedroom
weakest sound we can hear
insulated lounge
coarse grinding
in the vicinity of a jet plane taking off
highest sound level that can occur
manual machine
air cooled electric motor 50 kw
spray painting


Critical health effects from noise
dB
140
120
85
70
55
35
30
0
Hearing impairment of adult (peak noise)
Hearing impairment of child (peak noise)
Hearing impairment (daily noise for 1 hour)
Hearing impairment (daily noise for 24 hrs)
Serious annoyance (outdoor)
Disturbance of communication
Sleep disturbance
Source: WHO

Audiometry

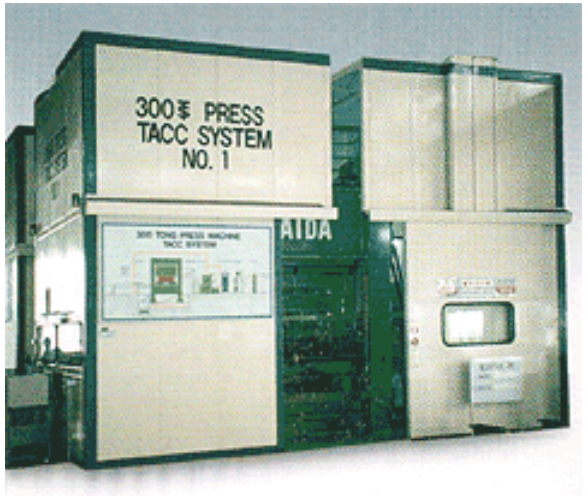
Portable audiometer

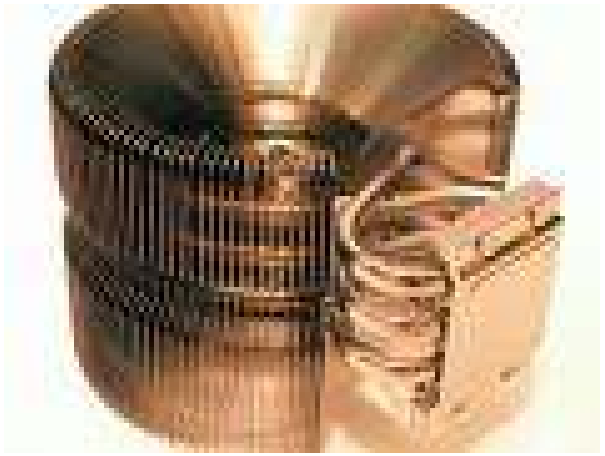


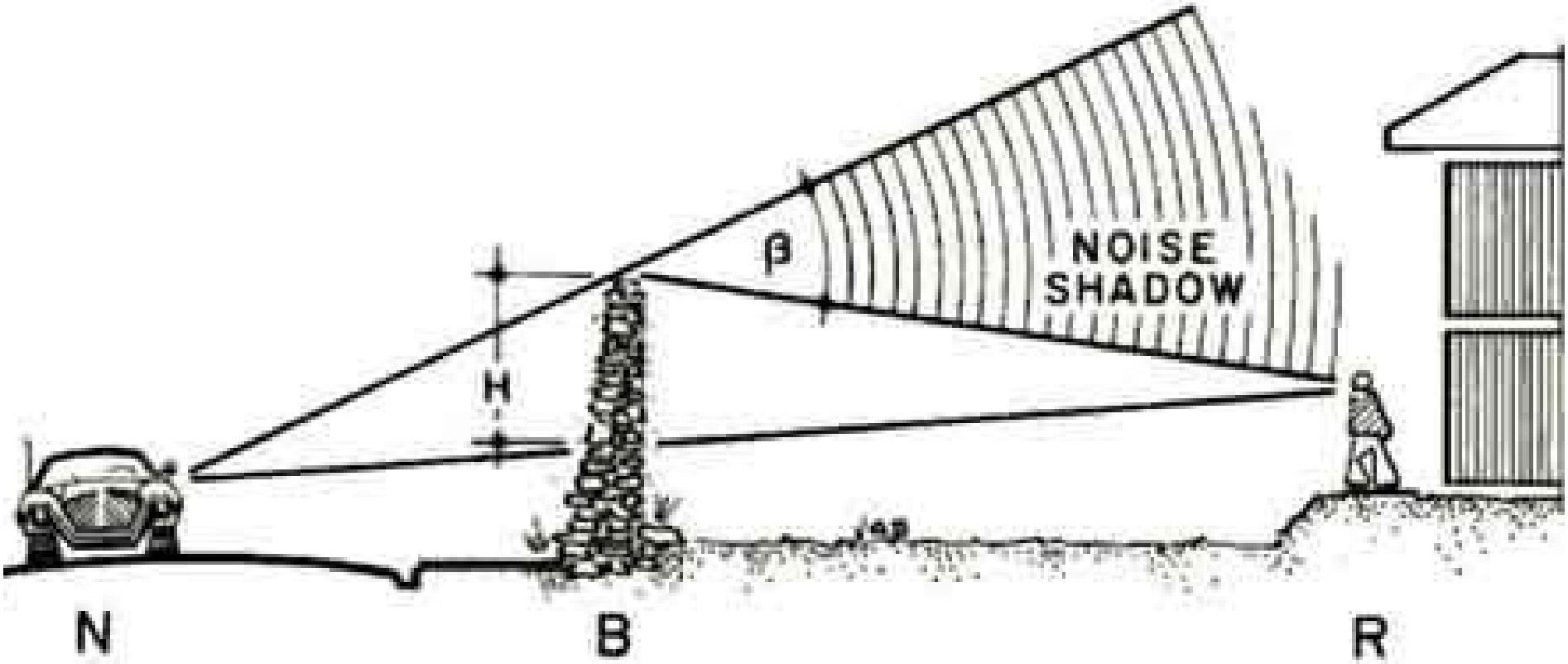
Remove any element and overexposure to noise is prevented

Reduce **loudness** or **duration** and exposure is reduced

Noise





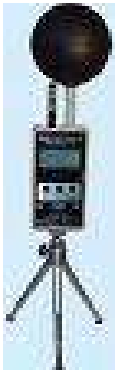

β
NOISE
SHADOW
H
N
B
R

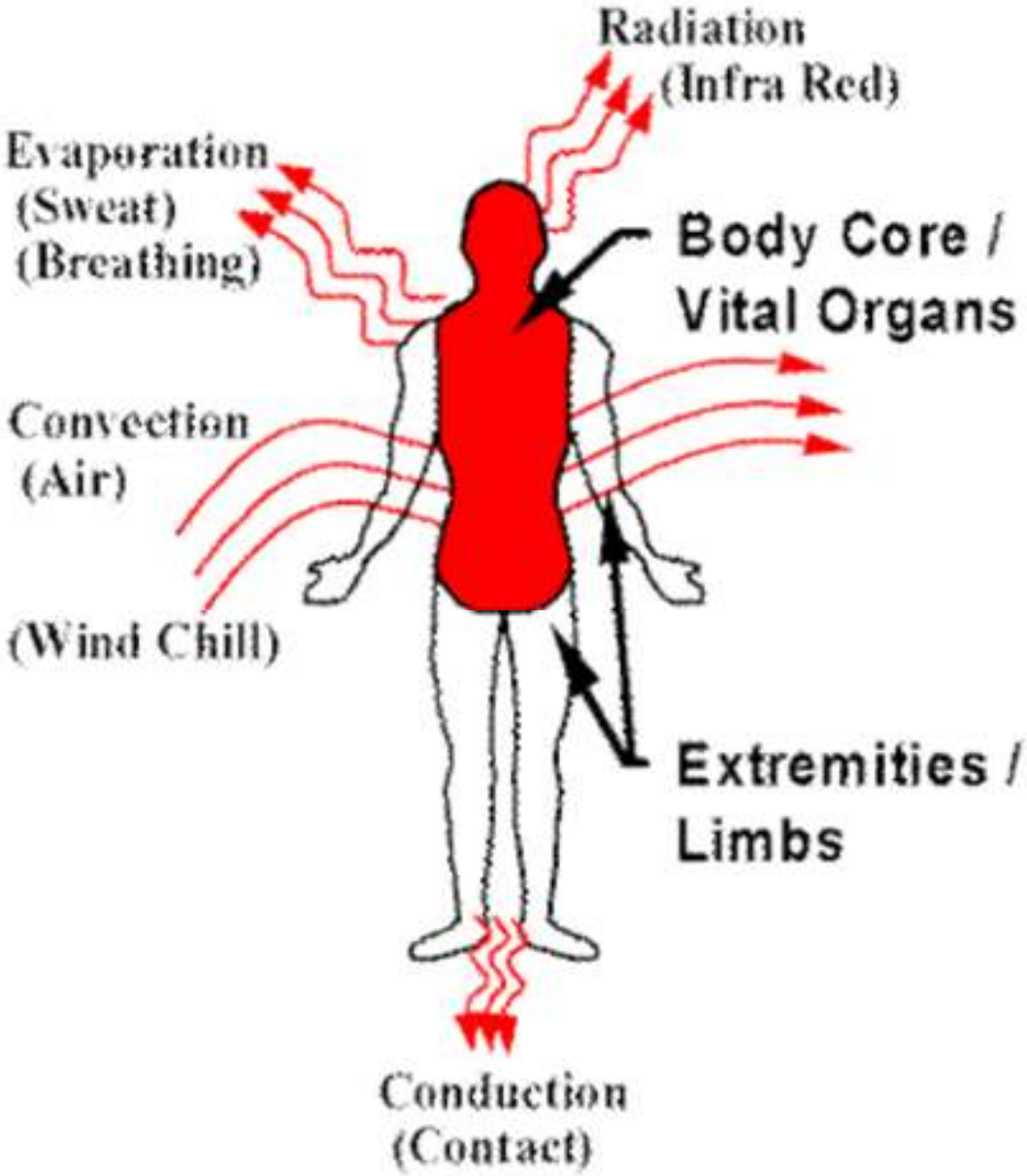
Air temperature

Air humidity

Air speed

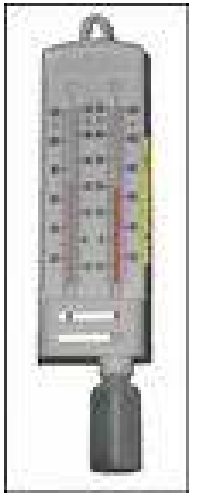
Radiant heat



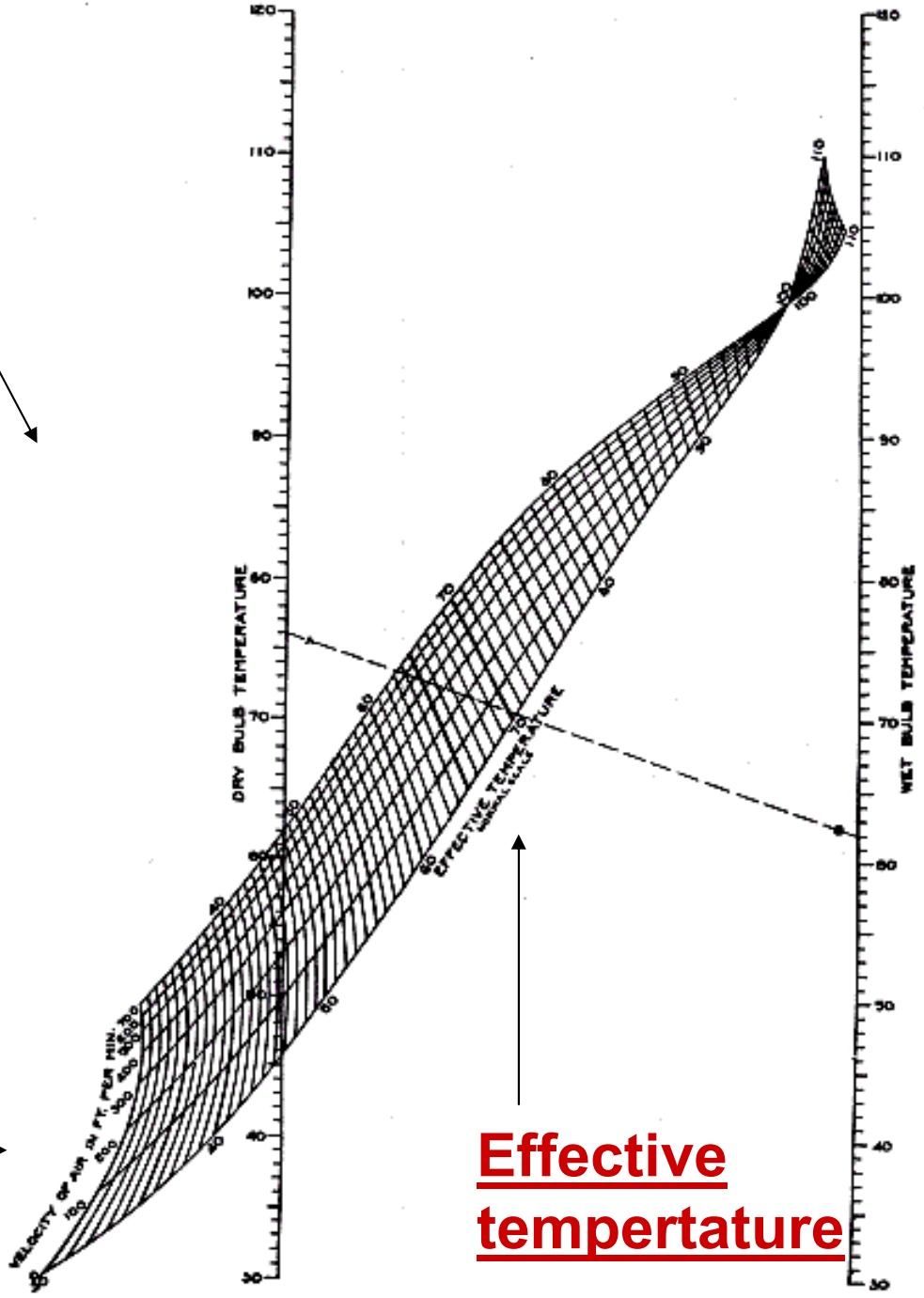

Radiation
(Infra Red)
Evaporation
(Sweat)
(Breathing)
Body Core /
Vital Organs
Convection
(Air)
(Wind Chill)
Extremities /
Limbs
Conduction
(Contact)

Dry bulb temperature

Wet bulb temperature



Air movement



Effective tempertature

Heat exposure

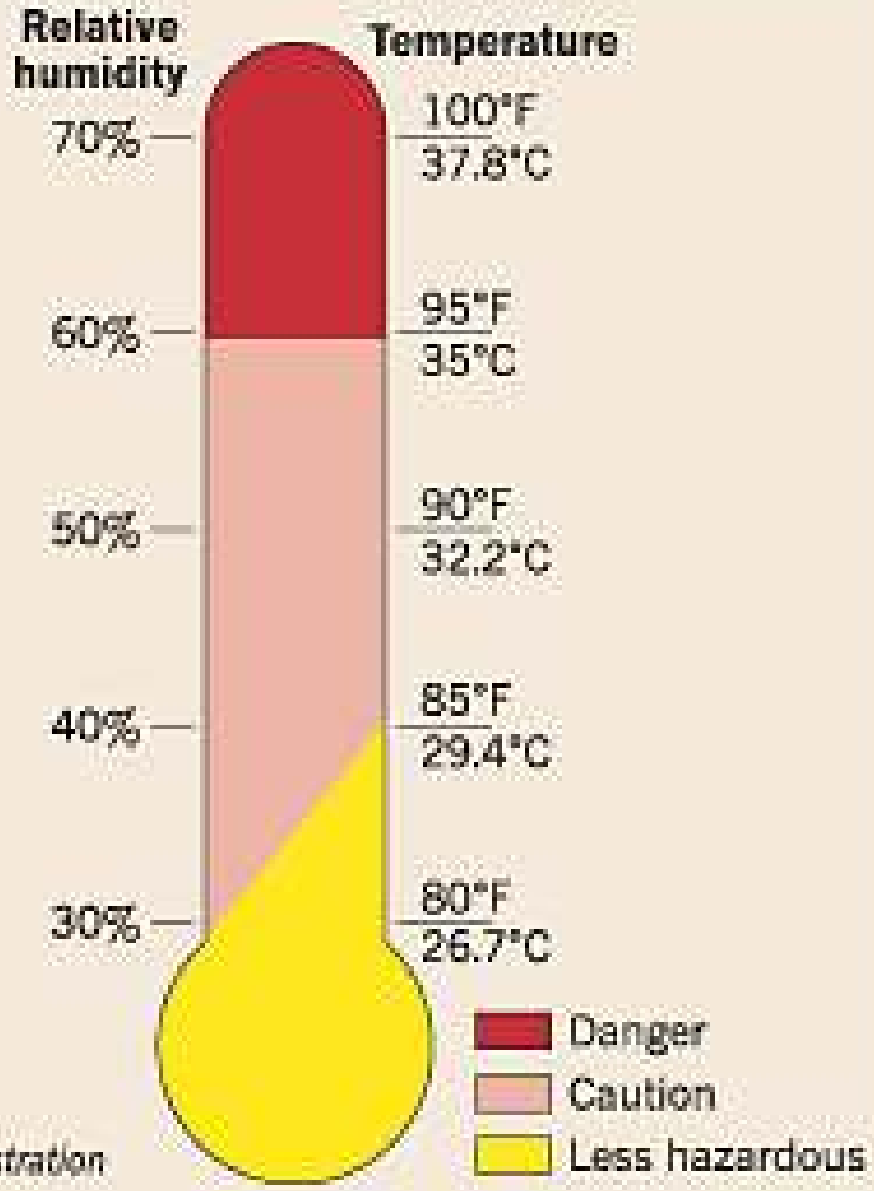
Dry bulb = ± 0.2 C from 5-55 C
Globe = ± 0.2 C from 5-70 C
RH = ± 2% from 0-95% non condensing
Wind speed = ± 0.2 m/sec or 10%, whichever is
the greater, from 0.1-8.0 m/sec
Pressure = ± 1.5 KPA from 40-115 KPA

Heat exposure threshold limit values (TLVs) in Hungary - **for a work shift averages in ET (CET)**

- Office work: 31 C^o
- Light physical work: 31 C^0
- Moderate physical work: 29 C^0
- Heavy physical work: 27 C^0

High Temperature + High Humidity + Physical Work = Heat Illness

When the body is unable to cool itself through sweating, **serious** heat illnesses may occur. The most severe heat-induced illnesses are heat exhaustion and heat stroke. If left untreated, **heat exhaustion** could progress to **heat stroke** and possible **death**.



Source: U.S. Department of Labor, Occupational Safety and Health Administration

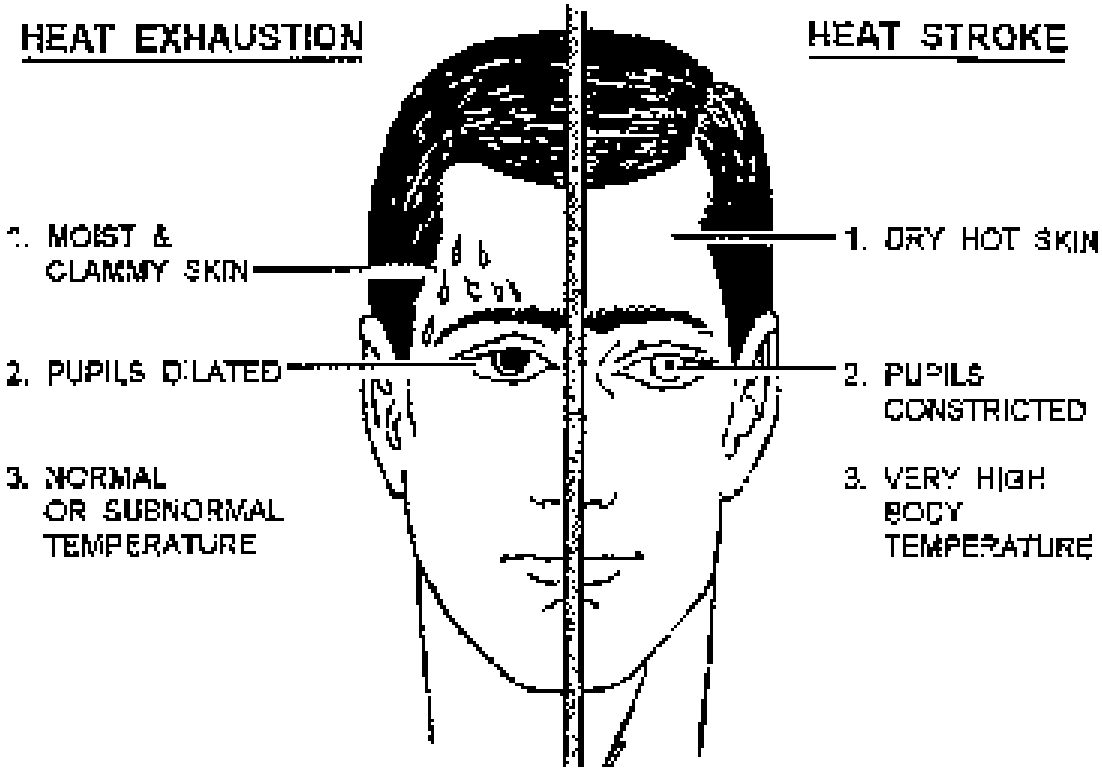
Heat stress - could lead to

heat collapse

heat cramps

heat exhaustion

heat stroke



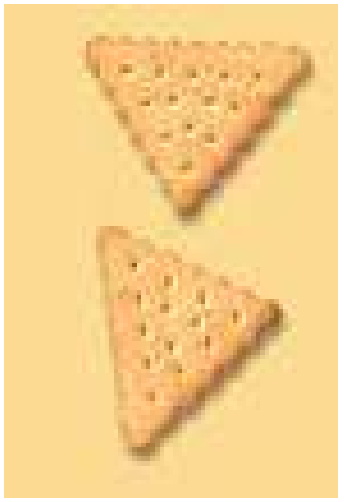
Medical examinations

Acclimatization

Technical solutions

Short „cooling-off” breaks

Replacment of water and salt



California employers are required to take these four steps to prevent heat illness

1. Training

Train all employees and supervisors about heat illness prevention.

2. Water

Provide enough fresh water so that each employee can drink at least 1 quart per hour, *and encourage them to do so.*

3. Shade

Provide access to shade for at least 5 minutes of rest when an employee believes he or she needs a preventative recovery period. *They should not wait until they feel sick to do so.*

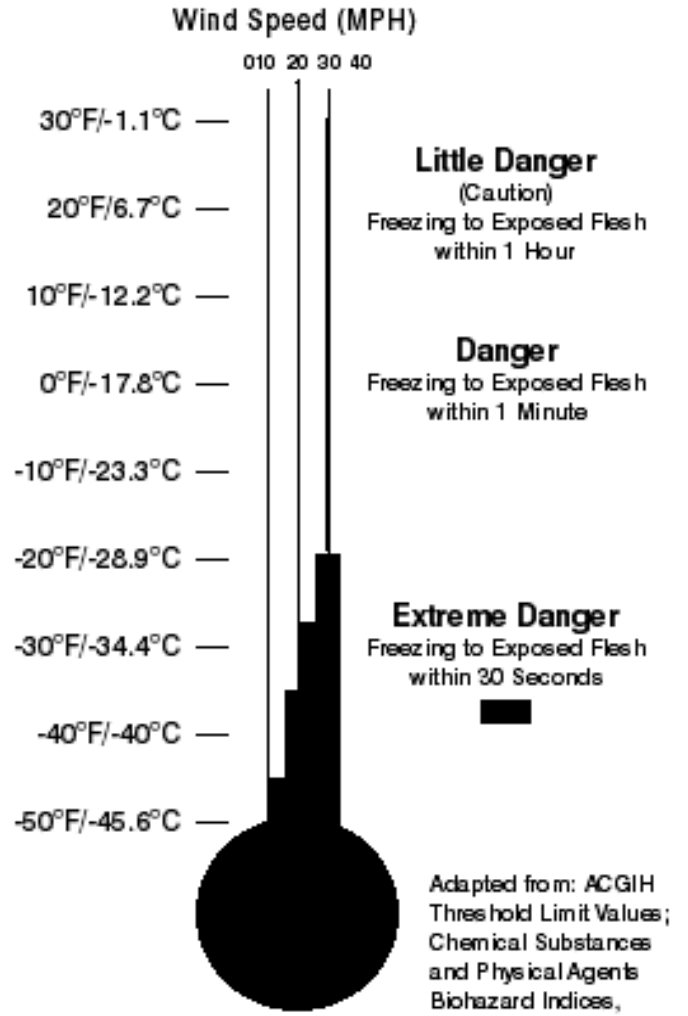
4. Planning

Develop and implement written procedures for complying with the Cal/OSHA Heat Illness Prevention Standard.

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result.

Hypothermia can occur when *land temperatures* are above freezing or *water temperatures* are below 98.6°F/ 37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds or wet clothing.



Adapted from: ACGIH Threshold Limit Values; Chemical Substances and Physical Agents Biohazard Indices, 1998-1999.

Physical work

- light physical work comprises types of activity with energy use of 930 kJ/h or less

- moderate physical work comprises types of activity with energy use of 936 - 1140 kJ/h

- heavy physical work comprises types of activity with 936 - 1140 kJ/h

- very heavy physical work comprises types of activity with 1146 - 1350 kJ/h

Static work

Dynamic work

Mental work

- less than 20 decision / minute: **underburden**
- more than 60 decision / minute **overburden**

Psychosocial health hazards

- sense of insecure livelihood
- shiftwork or extreme work schedules
- separation from familiar environment (e.g. family), commuting
- workplace conflicts, bulling
- information deprivation of work tasks
- lack of control over work

What is the difference between tiredness and fatigue?

Fatigue is generally described as a state of feeling tired, weary,
or sleepy that results from prolonged mental or physical work,
extended periods of anxiety, exposure to harsh environments,
or loss of sleep.
The result of fatigue is impaired performance and diminished alertness.