Occupational Diseases 2

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Topics Covered:

- Occupational Lung Disease
- CNS Disorders
- Liver and Renal Disorders
- Reproductive Disorders
- Musculoskeletal
- Skin
- Noise-induced hearing loss
- Heat Stress
- Sick Building Syndrome
- Cancers

Reproductive & Development Disorders

- Toxins can damage germ cells leading to
  - impotence,
  - menstrual irregularities,
  - infertility,
  - abnormal foetal development (congenital malformations,intrauterine deaths, spontaneous abortion)
- > 800 chemicals lead to adverse reproductive effects in animals
- about 25 agents cause such effects in man

Epidemiologic Studies in Reproductive Disorders

- Outcome related to exposure of father as well as mother
- Reproductive impairment and losses difficult to measure/record
  - e.g. early spontaneous abortion unnoticed
- Control of confounding factors

Confounding Factors in Study of Toxic Exposure and Adverse Reproductive Effects

- Concurrent drug exposure
  - cigarettes, alcohol, pharmaceuticals
- Contraceptive use
- Surgery (vasectomy, tubal ligation)
- Maternal age and parity; paternal age
- Genetic factors
- Infections disease
- Concurrent illness
- Nutritional deficiencies

Male Reproductive Hazards

Type of Exposure	Observed Effects			
	Lower number of Sperm	Abnormal Sperm Shape	Altered Sperm Transfer	Altered Sperm/ Sexual Performance
Lead	X	X	X	X
Dibromochloropropane	X			
Carbaryl (Sevin)		X		
Toluenediamine and dinitrotoluene	X			
Ethylene dibromide	X	X	X	
Plastic production (styrene and acetone)		X		
Ethylene glycol monoethyl ether	X			
Welding		X	X	
Perchloroethylene			X	
Mercury vapor				X
Heat	X		X	
Military radar	X			
Kepone**			X	
Bromine vapor**	X	X	X	
Radiation** (Chernobyl)	X	X	X	X
Carbon disulfide				X
2,4-Dichlorophenoxy acetic acid (2,4-D)		X	X	

Female Reproductive Hazards

Table 1. Chemical and physical agents that are reproductive hazards for women in the workplace

Agent	Observed effects	Potentially exposed workers
Cancer treatment drugs (e.g., methotrexate)	Infertility, miscarriage, birth defects, low birth weight	Health care workers, pharmacists
Certain ethylene glycol ethers such as 2-ethoxyethanol (2EE) and 2-methoxyethanol (2ME)	Miscarriages	Electronic and semiconductor workers
Carbon disulfide (CS_2)	Menstrual cycle changes	Viscose rayon workers
Lead	Infertility, miscarriage, low birth weight, developmental disorders	Battery makers, solderers, welders, radiator repairers, bridge repainters, firing range workers, home remodelers
Ionizing radiation (e.g., X-rays and gamma rays)	Infertility, miscarriage, birth defects, low birth weight, developmental disorders, childhood cancers	Health care workers, dental personnel, atomic workers
Strenuous physical labor (e.g., prolonged standing, heavy lifting)	Miscarriage late in pregnancy, premature delivery	Many types of workers

Table 2. Disease-causing agents that are reproductive hazards for women in the workplace

Agent	Observed effects	Potentially exposed workers	Preventive measures
Cytomegalo-virus (CMV)	Birth defects, low birth weight, developmental disorders	Health care workers, workers in contact with infants and children	Good hygienic practices such as handwashing
Hepatitis B virus	Low birth weight	Health care workers	Vaccination
Human immuno-deficiency virus (HIV)	Low birth weight, childhood cancer	Health care workers	Practice universal precautions
Human parvovirus B19	Miscarriage	Health care workers, workers in contact with infants and children	Good hygienic practices such as handwashing
Rubella (German measles)	Birth defects, low birth weight	Health care workers, workers in contact with infants and children	Vaccination before pregnancy if no prior immunity
Toxoplas-mosis	Miscarriage, birth defects, developmental disorders	Animal care workers, veterinarians	Good hygiene practices such as handwashing
Varicella-zoster virus (chicken pox)	Birth defects, low birth weight	Health care workers, workers in contact with infants and children	Vaccination before pregnancy if no prior immunity

Musculoskeletal Disorders

Musculoskeletal Disorders

- Soft-tissue injury in which
  - muscle,
  - nerves, or
  - tendons become irritated or inflamed.

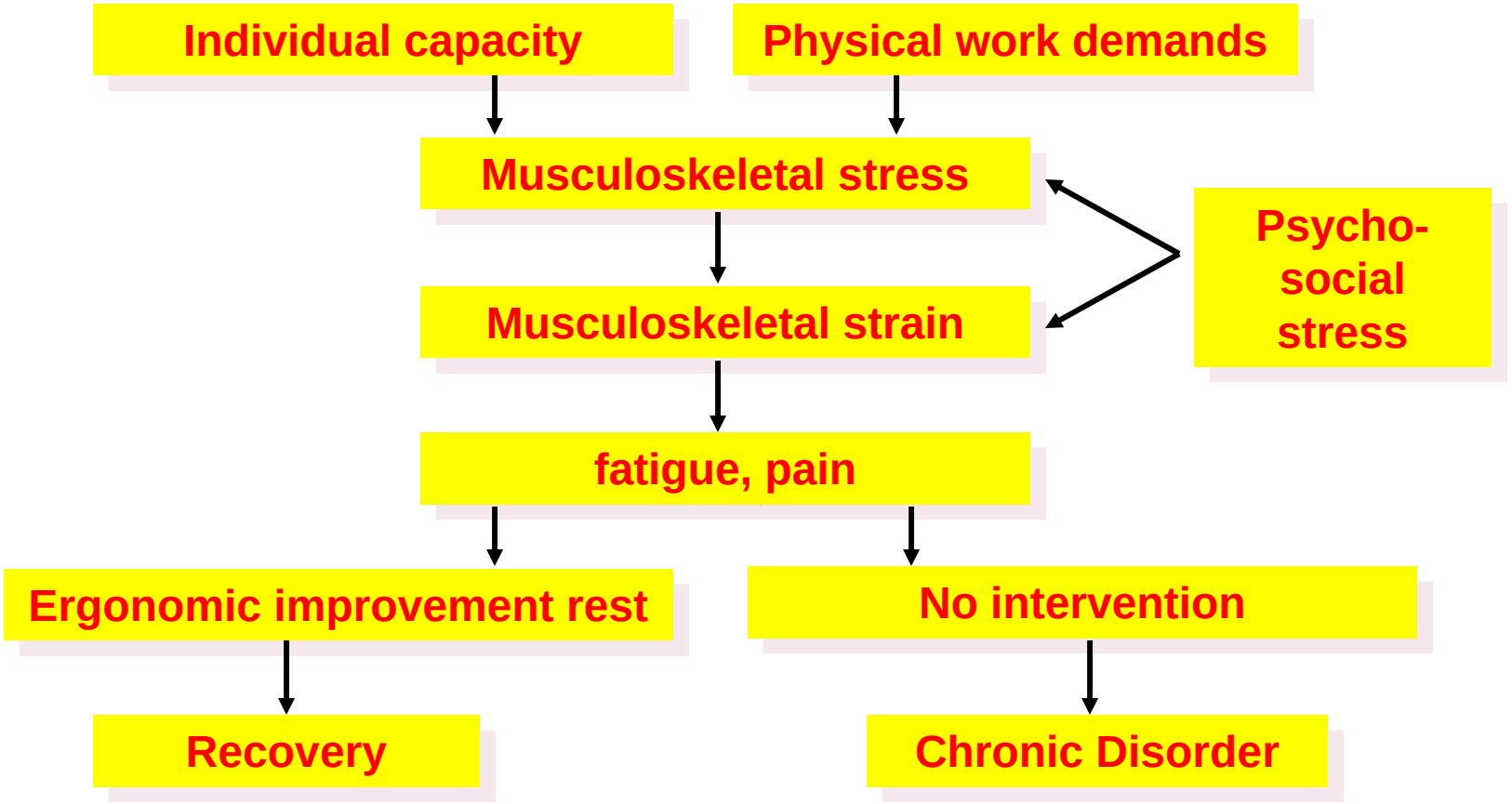
Musculoskeletal Disorders

- Caused by
  - Repetitive motions,
  - Excessive force, and
  - Extremes of motion
- Differ in severity from mild periodic symptoms to severe chronic and debilitating conditions

Also known as …

- MSI Musculoskeletal Injuries
- RSI Repetitive Strain Injuries
- RMI Repetitive Motion Injuries
- CTD Cumulative Trauma Disorders
- WMSD Work-related Musculoskeletal Disorders.

Model of Musculoskeletal Disorders



(Kilbom A (1988)

Work-related Musculoskeletal Disorders

- Low back pain
- Carpal tunnel syndrome
- Tendonitis
  - Lateral Epicondilytis (Tennis Elbow)
  - Median Epicondilytis (Golfer's Elbow)
- Tenosynovitis

Risk Factors

- Work organisation
- Biomechanical
- Non-work

Work Organisation

- Work-rest cycles
- Excessive work pace/duration
- Unaccustomed work
- Lack of task variability
- Machine-paced work
- Piece work

Biomechanical Factors

- Repetitive, forceful or prolonged exertions
- Frequent or prolonged lifting
- Pushing, pulling or carrying heavy loads
- Fixed, awkward postures
- Contact stress
- Vibrating or impact tools or equipment

Non-Work Factors

- Age
- Sex
- Medical conditions
- Psychosocial factors

Ergonomics

- “fitting the person to the job, and the job to the person”

What is Ergonomics?

- Study of how people physically interact with their work
  - fitting the job, the equipment, the work environment and work organisation to the person
  - Ergo – *Greek word "Work"*
  - Norm – Law

Neutral Posture

- Where there is less use of muscle or compression of nerves

What is an Occupational Skin Disease ?

- An occupational skin disease (OSD) is any skin disorder which is caused by exposure to work place hazards.
- A person's existing skin disorder may also be made much worse by work activities, and such cases are also considered as OSDs.

Types of common OSD

- Contact dermatitis
- Contact urticaria
- Acne
- Pigmentary disorders
- Skin cancer
- Skin infection

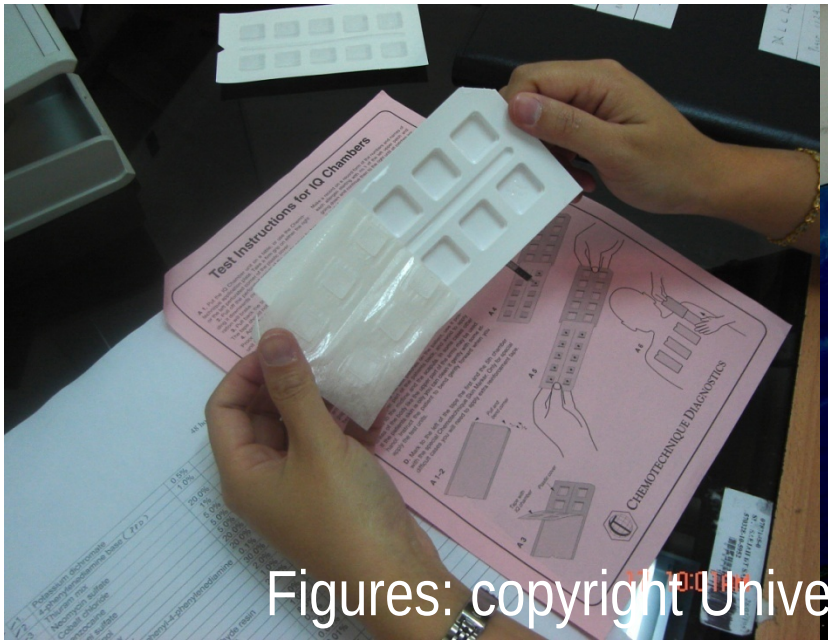
Diagnostic Tests

- Patch Tests
- Prick Tests
- Scratch Test
- Open Test
- Usage Test

Patch Tests

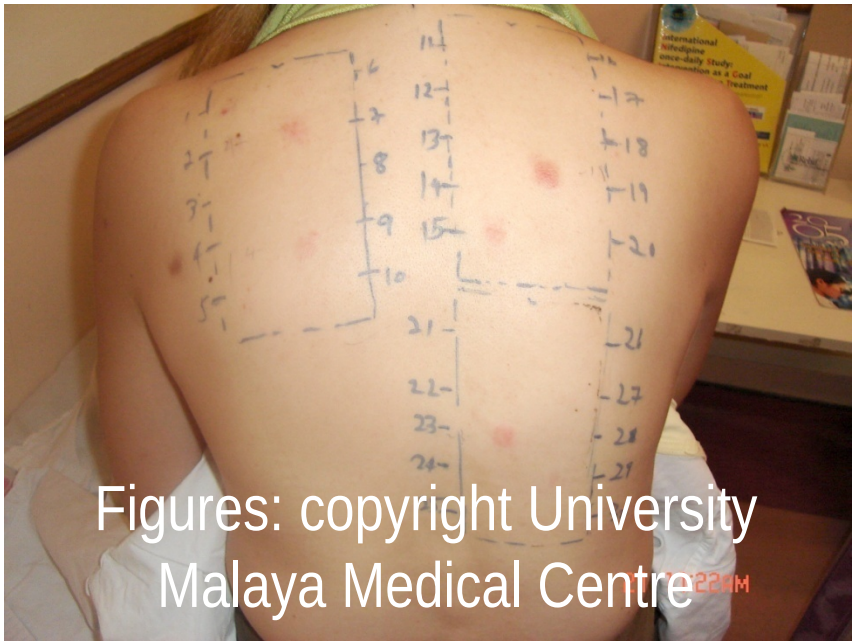
- Diagnosis of allergic contact dermatitis
- Hapten (~0.001-20%) in vehicle
- Finn Chamber
- 48 h application on back
- Reading at 2 days, 4-5 days (7-9 days)

Skin Patch Test



Figures: copyright University Malaya Medical Centre

Reading of Patch test



- ?+ (erythema),
- + (erythema, edema),
- ++ (+vesiculation),
- +++ (+ bulla),
- IR (irritation)

Prick Tests

- A drop of allergen placed on top of skin
- Skin broken with lancet
- Positive control histamine
- Negative control vehicle
- Positive reaction: at least 3 mm **and** histamine size
- Overall negative: Antihistamine
- Overall positive: Dermografismus

Noise-induced Hearing Loss (NIHL)

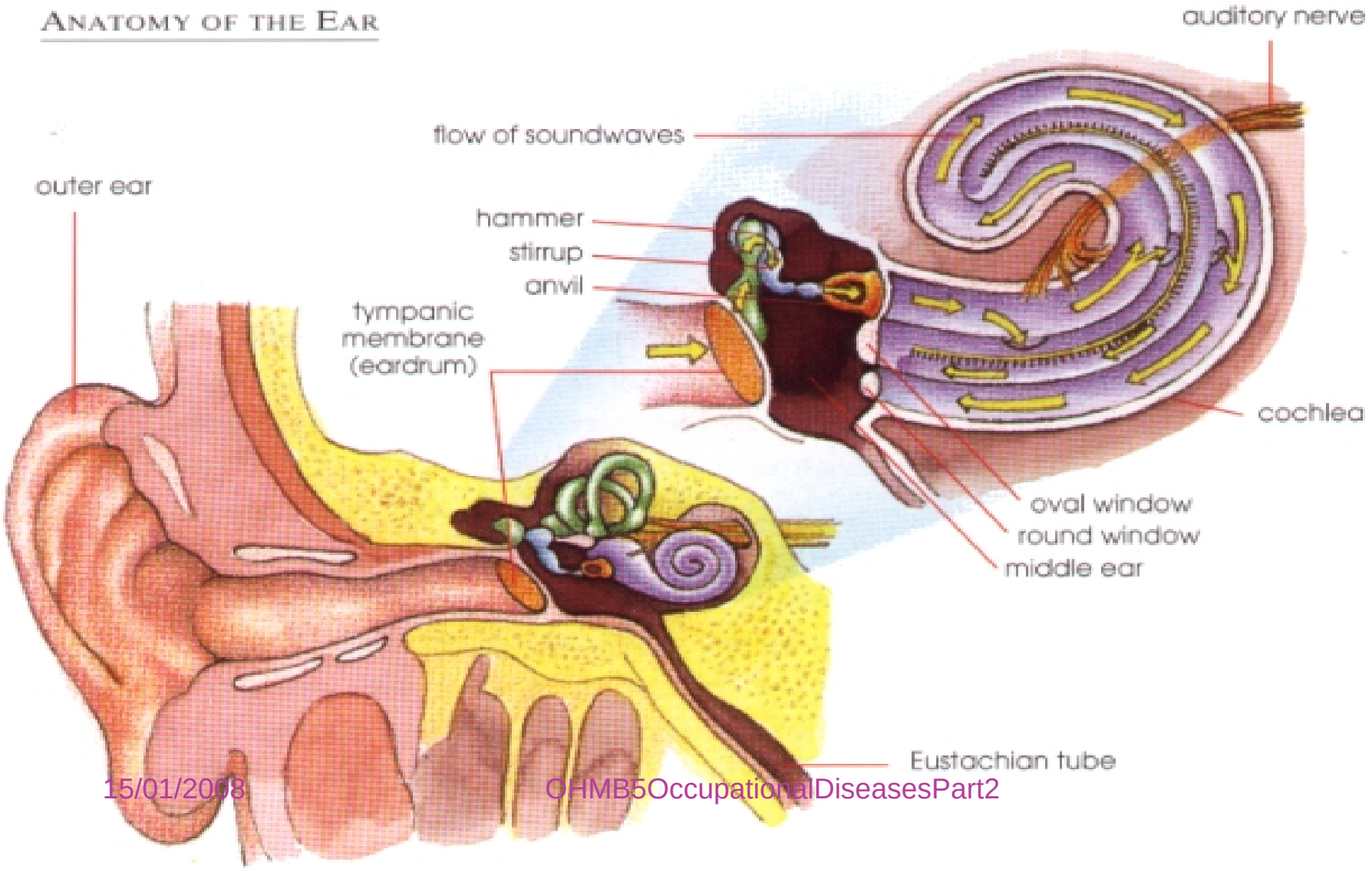
Definition

- Sound
  - Movement (pressure variation) of air, water or any in any medium which can be heard by the human ear
- Noise
  - Unwanted sound

Mechanism of Hearing

- External Ear –
  - To capture and transmit the sound to the ear drum
- Middle Ear –
  - To amplify the sound received and transmit it to the fluid filled Inner Ear
- Inner Ear –
  - The Organ of Corti in the Cochlea
  - Hair cells vibrate and convert the mechanical energy into electrical energy
  - Transmitted to the Auditory Cortex by the 8th Nerve
  - Semi-circular canal for balancing

Anatomy of the Ear



Prevalence Of NIHL

- 50% Malaysian industrial workers at risk of permanent hearing impairment
- 22% already with detectable hearing impairment
  - 45,974 workers sampled from 302 factories – June 1990
- Textile industry highest risk (60%)

Relationship between Intensity, Pressure and dB SPL

Intensity (watts/m^2)	Pressure (micorpascals)	dB SPL	Examples
1	20,000,000	120	Jet engine
0.01	2,000,000	100	Rock drill
0.0001	200,000	80	Busy traffic
0.000001	20,000	60	Office
0.00000001	2,000	40	Soft music
0.0000000001	200	20	Quiet home
0.000000000001	20	0	Hearing threshold

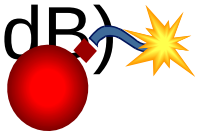
Physical Aspects

- Average sound energy expressed as equivalent sound pressure level (Leq)
- Sound frequencies expressed in Hertz (Hz) or cycles per second
- Audible sound 20 – 20,000 Hz
- Speech mainly 500 – 6,000 Hz
- Noise measured by sound level meters
- Hearing measured by audiometers

Type of Noise

- Continuous (varies <3dB)
- Fluctuating (varies >3dB)
- Intermittent (level drops to ambient level several times, each for >1 sec.)

- Impact (change >40dB, lasting <0.5 sec.)
- Impulse (same as impact noise but >140dB)



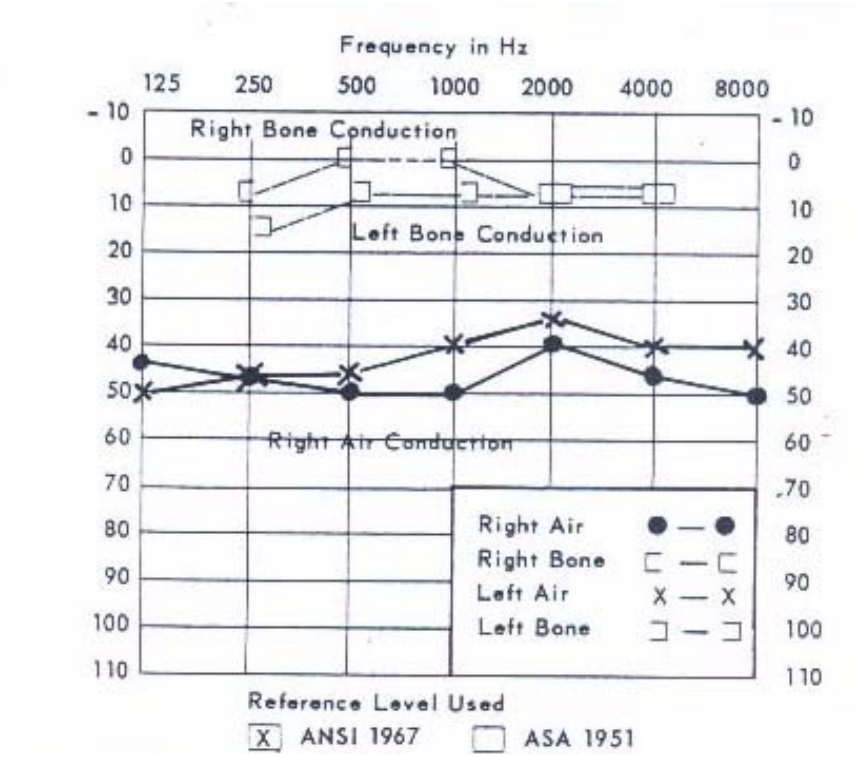
Ill Effects of Noise Exposure

- Cause ringing in the ears leading to distraction, lack of concentration and poor sleep.
- Affect the sense of balance causing dizziness
- Source of stress leading to headache and irritability.
- Increases risk of accidents by masking sounds of danger and warning
- Causes hearing loss.

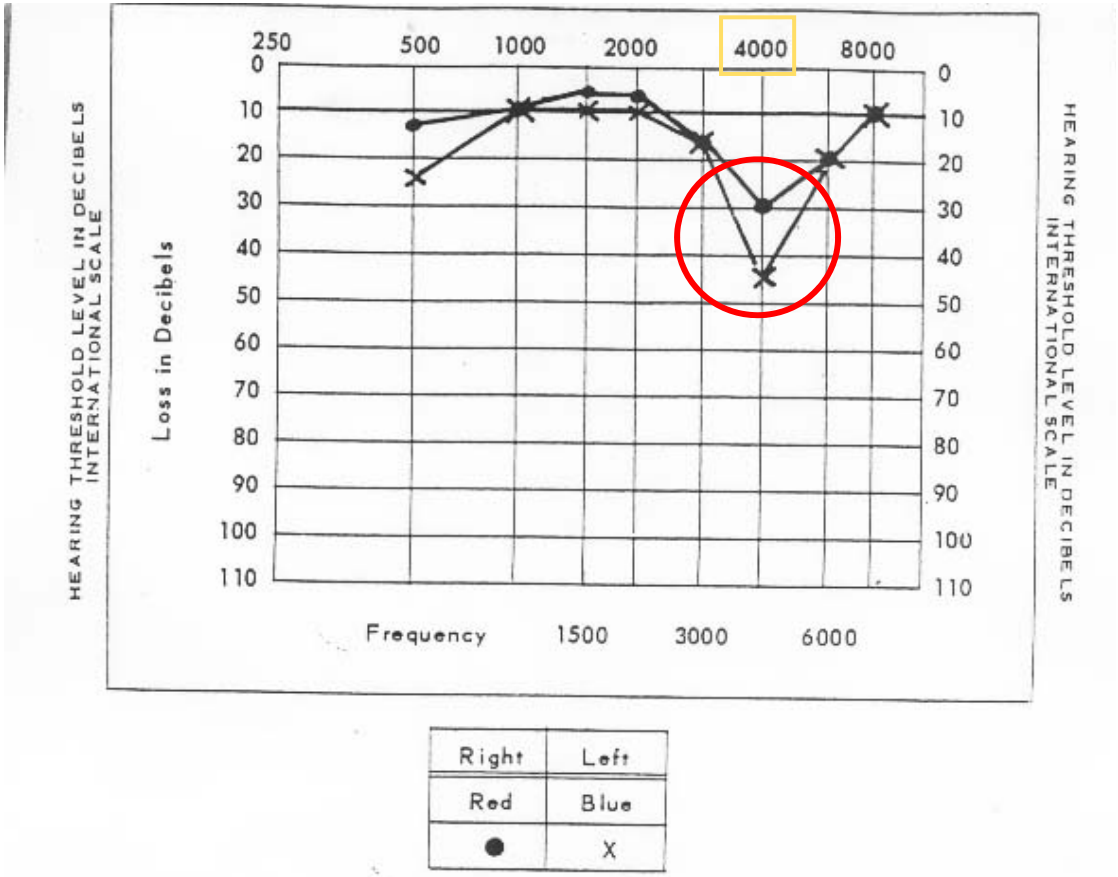
Harmful Affects of Noise

- Conductive Hearing Loss
  - caused by physical, traumatic or infective agents to the outer or middle ear
- Sensorineural Loss
  - problem involving the inner ear
- Mixed Hearing Loss
  - combination of both conductive and sensorineural loss

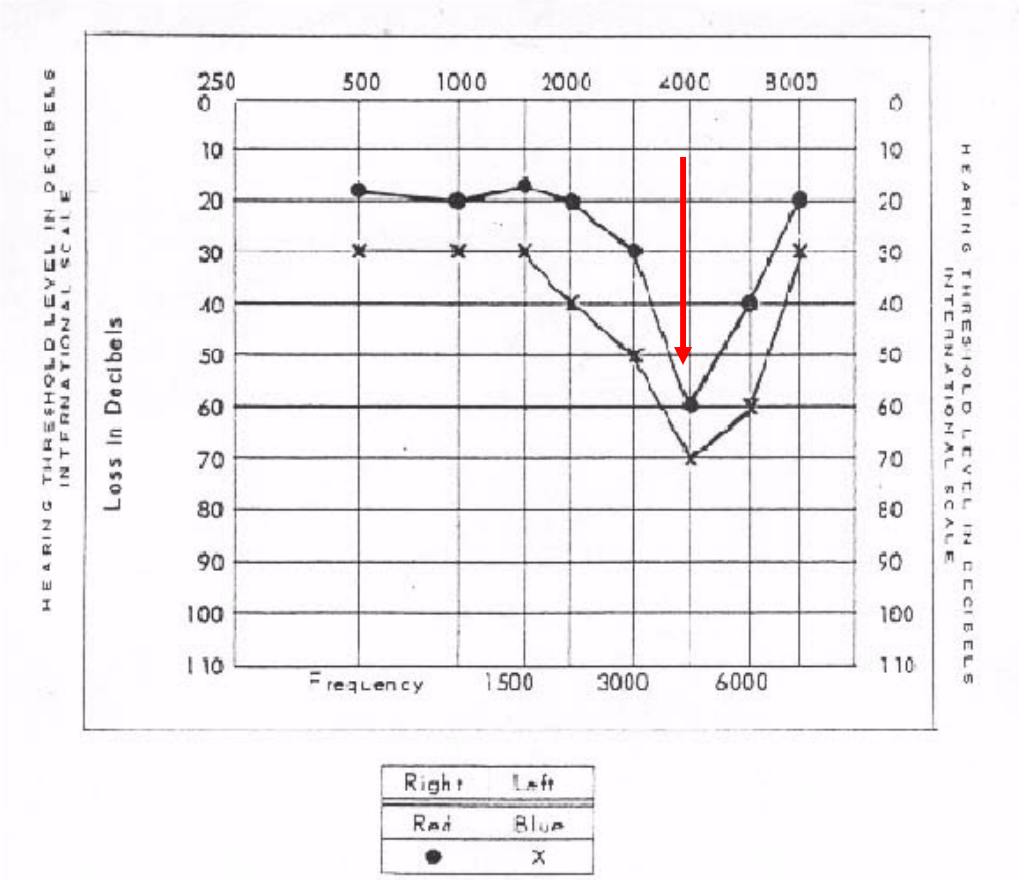
Conductive loss



Early NIHL



Advanced NIHL



The Effects Of Exposure

- Temporary Threshold Shift (TTS)
  - Occurs immediate after brief exposure
  - Diminishes with time if no further exposure
  - Recovery within 16 hours
  - Prolonged or repeated exposure lead to permanent damage
- Permanent Threshold Shift (PTS)
  - Irreversible damage with permanent hearing loss

Medical diagnosis: History

- Chief complaint
- Present illness
- System review
- Medical/surgical history, allergies, drugs
- Current medications
- Social history
  - include hobbies/past-time activities
- Occupational history
  - current/previous jobs, full -time/part-time
- Family history
- Environmental exposure

Medical Diagnosis: Symptoms

- For the chief complaint (hearing loss, tinnitus, vertigo, etc), document
  - Nature of complaint
  - Its severity
  - Its chronology (date of onset, changes over time, frequency and duration of episodes)
  - Aggravating/relieving factors or triggering episodes
  - How it effects patient's daily life I.e. perceived disability

Medical Diagnosis: Physical/Lab examination

- Head and neck examination
- Cranial nerves and cerebellar tests – balance, fine motor coordination, spatial sense
- Otoscopy (canal blockage, infections and sequelae of old infection can be observed)
- Tuning fork tests (Weber and Rinne tests)
- Tests of cochlear function
- Imaging (CT/MRI to exclude acoustic neuroma)
- pure tone audiometry

Audiometric Testing Programme

- Baseline test done within 6 months of work in area with noise = or > Action level (85 dB(A))
- Test repeated annually or once in 2 years
  - Test repeated annually
    - For worker in area = or > PEL (90 dB(A))
    - Whose baseline test showed hearing impairment
    - Whose annual test showed threshold shift
  - Test repeated once in 2 year
    - For worker exposed to noise between Action level and PEL (90 dB(A))

Heat Stress

Health Effects

- Skin rashes
  - skin sweaty
  - itchy, irritant rash
- Dehydration
  - mouth dry and feels thirsty
- Muscle cramps
  - muscle spasm – pain and sudden incapacitation

- Heat exhaustion
  - looks pale/flushed
  - feels weak, giddy, nausea
  - may vomit/faint
- Heat stroke
  - dry, hot skin
  - body temperature begins to rise
  - mental confusion, delirium
  - convulsions and loss of consciousness

Infectious Diseases

Infections

Tuberculosis	Healthcare workers
Nipah Encephalitis	Swine farmers
Leptospirosis	Sewage workers
HIV	Healthcare workers
HBV	Healthcare workers
Dengue	Construction workers
Malaria	Army
Avian flu	Chicken breeders

Indoor Air Quality

Primary Source of IAQ problem

- Inadequate ventilation 52%
- Contamination from inside building 16%
- Contamination from outside building 10%
- Microbial contamination 5%
- Contamination from building fabric 4%
- Unknown sources 13%

National Institute for Occupational Safety and Health (NIOSH), Feb., 1989. Personal Correspondence to Long Loo, Occupational Safety and Health Administration.

Sick Building Syndrome

- sometimes are attributed to the effects of a combination of substances or individual susceptibility to low concentrations of contaminants.
- Substance can be, airborne chemicals, mostly volatile organic compounds (VOC's) that can have a health impact even at low levels.

- Sick building syndrome reduces worker productivity and may also increase absenteeism.
- The symptoms are associated with periods of occupancy and often disappear after the worker leaves the worksite.

It is a condition associated with complaints of discomfort including

- headache;
- nausea;
- dizziness;
- dermatitis;
- eye, nose, throat, and respiratory irritation;
- coughing;
- difficulty concentrating;
- sensitivity to odours;
- muscle pain; and fatigue

Building-related illnesses

- Are those for which there is a clinically defined illness of known etiology and include
  - infections such as legionellosis and
  - allergic reactions such as hypersensitivity diseases
- Are often documented by physical signs and laboratory findings.

Legionellosis

- Legionellosis is an infection caused by the bacterium Legionella pneumophila. The disease has two distinct forms:
  - Legionnaires' disease, the more severe form of infection which includes pneumonia, and
  - Pontiac fever, a milder illness.
- Legionnaires' disease acquired its name in 1976 when an outbreak of pneumonia occurred among persons attending a convention of the American Legion in Philadelphia. Later, the bacterium causing the illness was named Legionella.

Major Indoor Contaminant

- Acetic Acid
- Carbon Dioxide
- Carbon Monoxide
- Formaldehyde
- Nitrogen Oxides
- Ozone
- Radon
- Volatile Organic Compounds
- Misc. Inorganic Gases
- Asbestos
- Synthetic Fibers
- Tobacco Smokes
- Micro organism

Risk of developing a particular cancer

- Some of the factors includes,
  - Personal characteristics such as age, sex, and race
  - Family history of cancer
  - Diet and personal habits such as cigarette smoking and alcohol consumption,
  - The presence of certain medical conditions,
  - Exposure to cancer-causing agents in the **environment**, and
  - Exposure to cancer-causing agents in the **workplace**.

The problem …

- Proportion of cancer deaths in Great Britain due to occupational exposures over the last few decades is 4%, with an associated uncertainty range of 2% to 8%.
  - *Ref: http://www.hse.gov.uk/statistics/causdis/cancer.htm*
- It is estimated that approximately 20,000 cancer deaths and 40,000 new cases of cancer each year in the U.S. are attributable to occupation
  - *Ref: http://www.cdc.gov/niosh/topics/cancer/*

- **Leukemia** (other than chronic lymphatic leukemia) or cancer of the bone, female breast, testis or thyroid due to exposure to **electromagnetic radiation** or ionising particles.
- Lung cancer
  - Related to Asbestos
  - Tin miners or in other workers due to exposure to arsenic, nickel (refining industry), chloromethyl ether, or zinc, calcium and strontium chromates.
  - Exposure to silica dust (various mining, quarrying, and stone industries, glass manufacturing, and foundries.)

Ref: http://www.hse.gov.uk/statistics/causdis/cancer.htm

- Acute non-lymphatic leukaemia due to exposure to benzene.
- Skin cancer due to exposure to arsenic, tar, pitch, bitumen, mineral oils or soot.
- Cancer of the nasal cavity or sinuses due to exposure to nickel compounds (refining industry), or wood, leather and fibreboard dust (manufacture/repair industry).

Ref: http://www.hse.gov.uk/statistics/causdis/cancer.htm

- Bladder cancer due to exposure various compounds during chemical manufacturing or processing, including 1-naphthylamine, 2-naphthylamine, benzidine, auramine, magenta, 4-aminobiphenyl, MbOCA, orthotoluidine, 4-chloro-2-methylaniline, and coal tar pitch volatiles produced in aluminium smelting.
- Angiosarcoma of the Liver due to exposure to vinyl chloride monomer.

Ref: http://www.hse.gov.uk/statistics/causdis/cancer.htm