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INSTITUTION OF SAFETY ENGINEERS (INDIA)

इंस्टीट्यूशन ऑफ सेफ्टी इंजीनियर्स (इंडिया)

WORK SAFER AND SAVE NATURE

"AIM TO PREVENT ACCIDENT, PROTECT ENVIRONMENT & MINIMISE LOSSES DURING DISASTER"



**OCCUPATIONAL
HEALTH HAZARDS
&
ITS PREVENTION
IN
PROCESS INDUSTRY**

By

Dr. SWAPAN KUMAR HALDAR

Conducted by

**Institution of Safety Engineers
(India)**

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Institution of Safety Engineers (India)

Welcome in Free
Webinar Session on
**OCCUPATIONAL HEALTH
HAZARDS
&
ITS PREVENTION
IN
PROCESS INDUSTRY**
on
**28th November 2022,
4:00 PM to 5:30 PM**



INSTITUTION OF SAFETY ENGINEERS (INDIA)

OCCUPATIONAL HEALTH HAZARDS & ITS PREVENTION IN PROCESS INDUSTRY



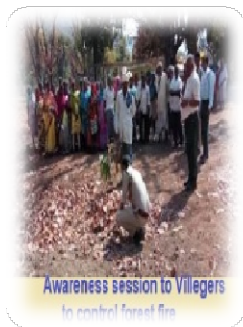
About us

Institution of Safety Engineers (India) is Non - Profitable organization set up in year 2012 under ZJEW Trust, Govt. Reg. No. 5240 and working with objective to prevent accident, protect environment & minimize losses during disaster. Institution of safety engineers (India) imparting safety, health, environment & quality related training to needy & provide similar services to industries, organization, institution to achieve zero harm.

MEMBERSHIP SERVICES



SAFETY HEALTH ENVIRONMENT RELATED TRAINING & SERVICES



JOURNAL PUBLICATION



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OUR SPEAKER

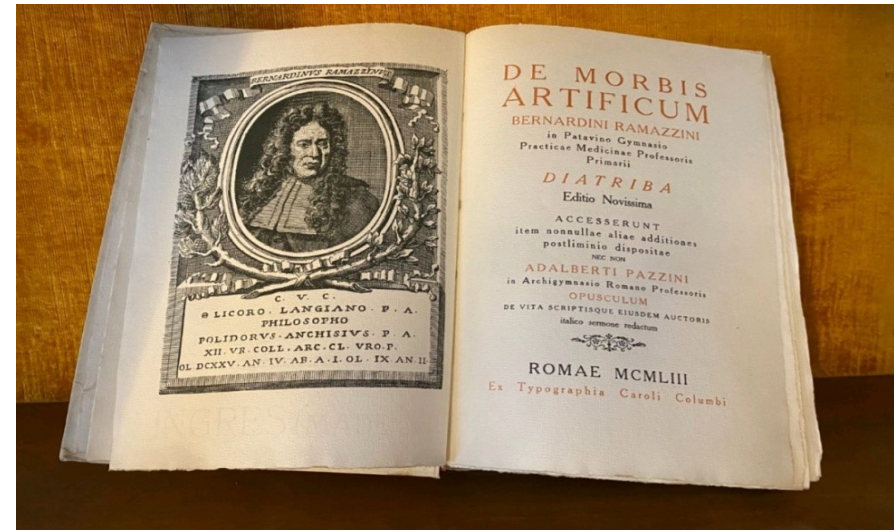


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Expert & Senior Member of Institution of
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SMISE Co-ordinator, Institution of Safety
Engineers (India)

B. RAMAZZINI (1633-1714)



PROCESS INDUSTRY & ITS QUALITY MANAGEMENT

Industries that extract, transport and process raw materials to manufacture semi-finished or high quality end products by means of physical, mechanical and/or chemical processes are classified as process industries.

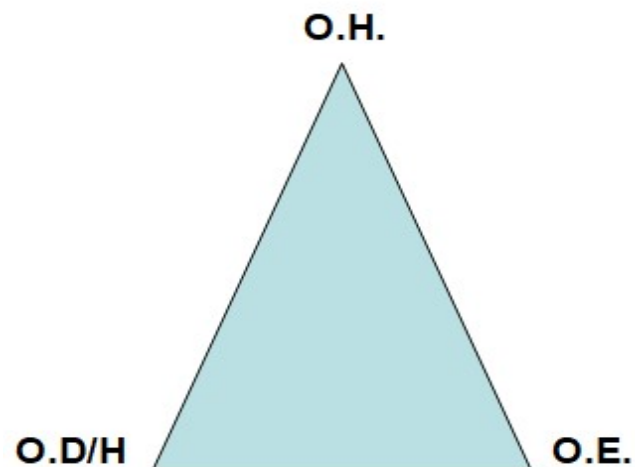
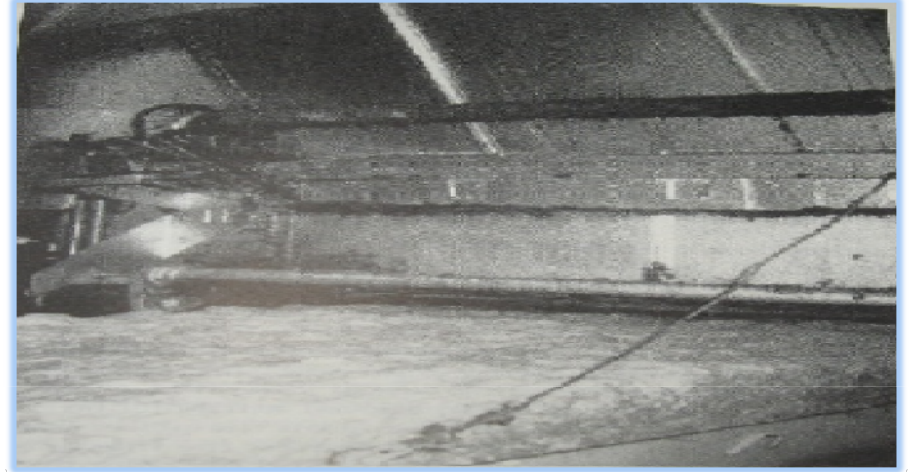
TOTAL QUALITY MANAGEMENT OF PROCESS INDUSTRY:

- Process Quality
- Product Quality &
- Human Quality

Coke Oven Plant



Rayon Industry



O.H.- Occupational Health

O.E.- Occupational Environment

**O.D/H- Occupational
Disease/Hazards**

OCCUPATIONAL HEALTH

- O.H. Is the promotion & maintenance of the highest degree of physical,
 - Mental & social well being of workers in all occupation.
 - It is a division of general medicine and is devoted to the prevention of occ. Disease & injury and to the promotion of health of people at work.
-

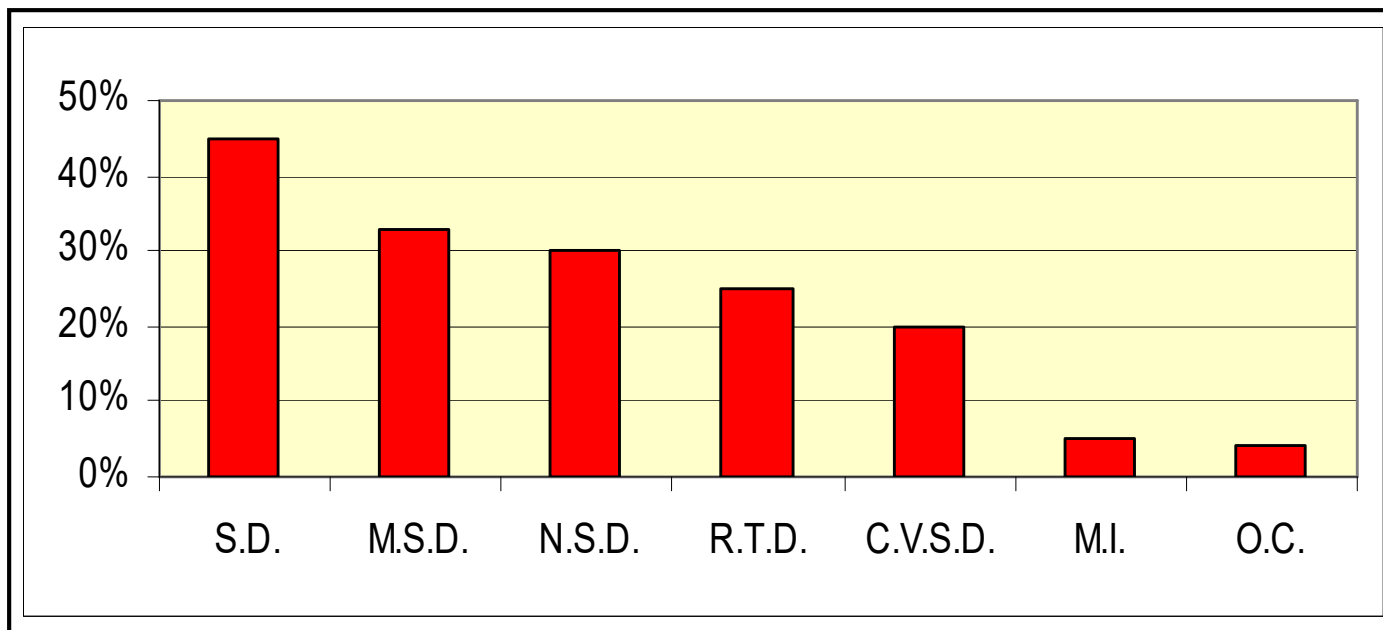
OCCUPATIONAL ENVIRONMENT

- Occupational environment is the external conditions & influences prevailed at the place of work & which has a bearing (direct and/or indirect effect) on the health of working population.
-

OCCUPATIONAL DISEASE

- The disease which arises out of or in course of occupation is known as occupational disease

ETIOLOGICAL FRACTION OF O.D.



ASTHMA WITH LATENCY

Spraying Isocyanate Paint



Paint Aerosol Fills the Shop



INTERACTION IN OCCUPATIONAL ENVIRONMENT

1. WORKERS vs. PHYSICAL AGENTS

CHEMICAL AGENTS

BIOLOGICAL AGENTS

2. WORKERS vs. MACHINE

3. WORKERS vs. WORKERS

TYPE OF HAZARDS

- PHYSICAL
- CHEMICAL
- BIOLOGICAL
- MECHANICAL
- PSYCHOSOCIAL



PHYSICAL AGENTS

- *HEAT*
- *COLD*
- *NOISE*
- *VIBRATION*
- *IONIZING RADIATION*
- *NON IONIZING RADIATION*
- *ELECTRICITY*

PHYSICAL AGENTS (contd.)

- *LIGHT*
- *A. BRIGHTNESS*
- *B. DARKNESS*
- *BAROMETRIC PRESSURE*
- *A. HIGH*
- *B. LOW*
- *U.S.G.(Ultra Sonography)*
- *E.M.F.(Electro Magnetic Field)*
- *MOISTURE*

Heat Stress

It is the amount of heat that is to be eliminated from human body to remain the body in thermal equilibrium and measured as the metabolic heat load and heat loss or gain through the process of Convection, Conduction, Radiation, and evaporation.

$$M + (R + C + K) - E = + S$$

General relation between work rate, heart rate and oxygen consumption

Category	O ₂ consumption (L/min)	Heart rate (Beat/min)
Light	0.5-1.0	75-100
Moderate	1.0-1.5	100-125
Heavy	1.5-2.0	125-150
Very Heavy	2.0-2.5	150-175
Extremely heavy	2.5	175

-: Effect of heat :-

Direct effect

Immediate Effect

- (i) Burns
- (ii) Heat Exhaustion
- (iii) Heat Cramp
- (iv) Heat Syncope
- (v) Heat hyperpyrexia
- (vi) Heat stroke
- (vii) Prickly heat

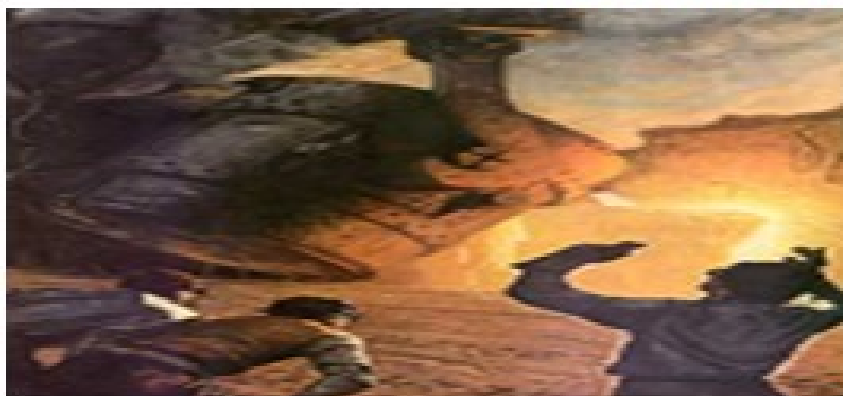
Late Effect

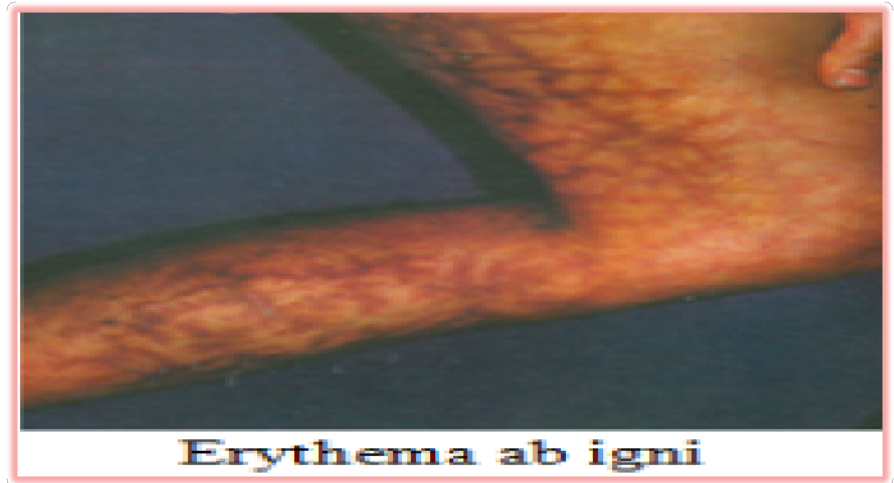
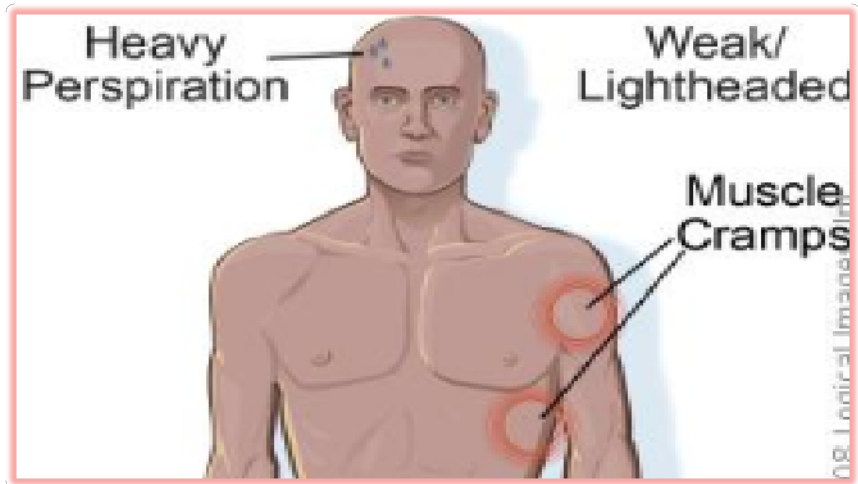
- (i) Cancer on face
(rodent ulcer)

Indirect effect

- (i) ↓ efficiency
- (ii) ↑ fatigue
- (iii) ↑ accidents
- (iv) Loss of emotional control
- (v) Sleeplessness
- (vi) Less productivity
- (vii) More error

Molten Metal Industries

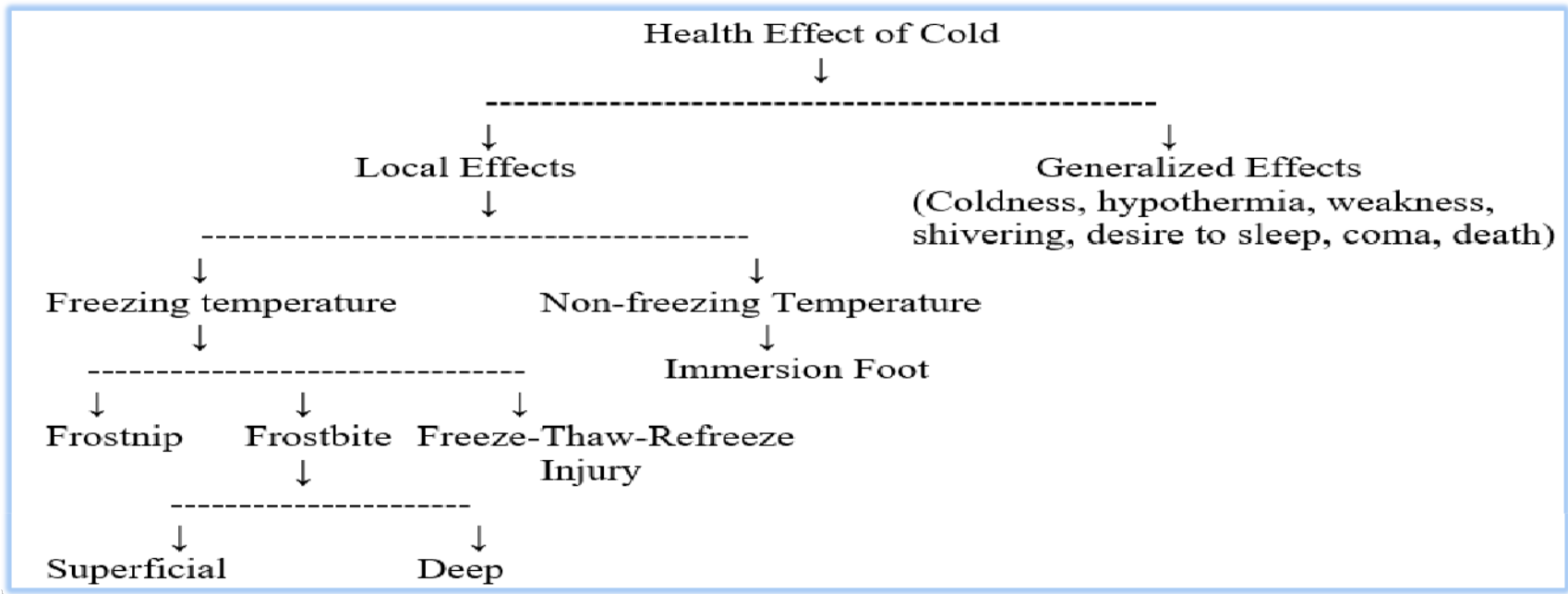




FIRE



Cold Injury



Frost Bite



Vibration

Health Hazards of Vibration



Hand-Arm Vibration



**Hand-Arm Vibration Syndrome
(White Finger)**



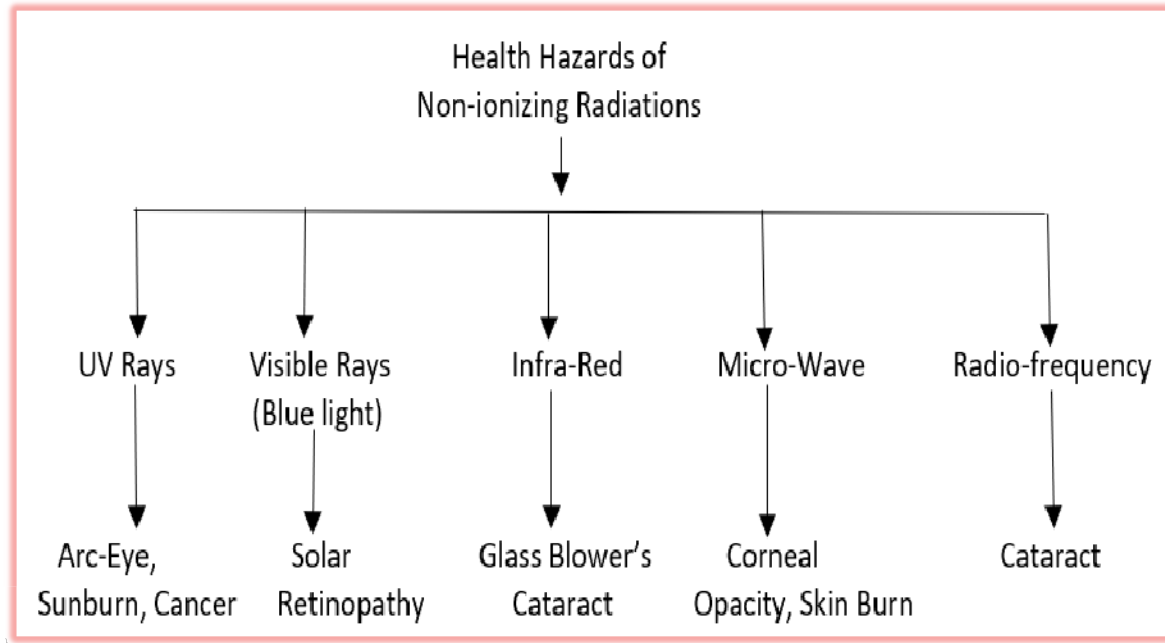
Whole Body Vibration



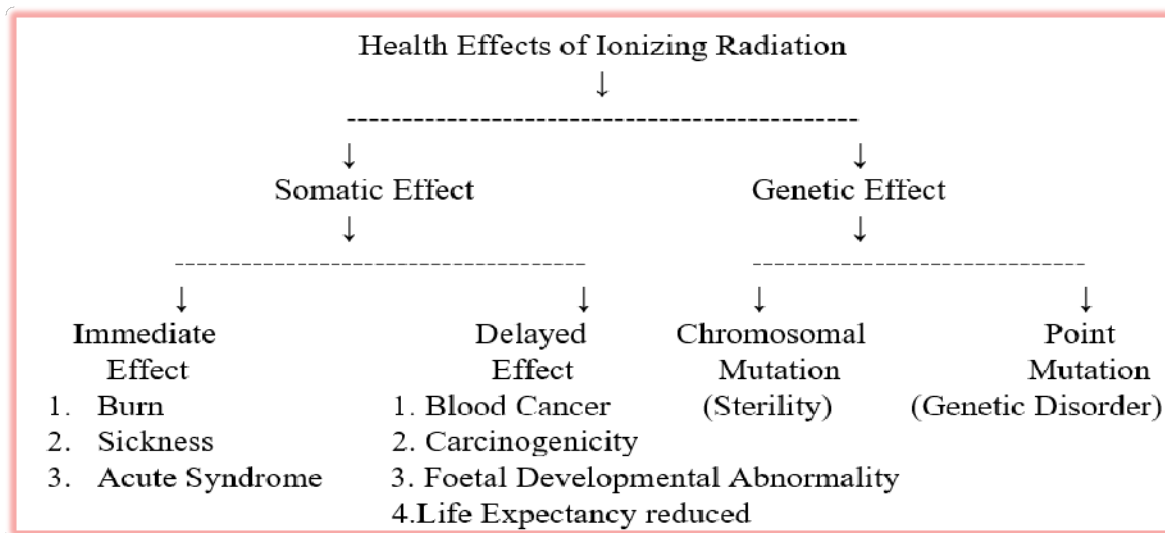
**Motion Sickness,
Low back pain**



NON-IONIZING RADIATION



Ionizing Radiation



Ionizing Burn



NOISE



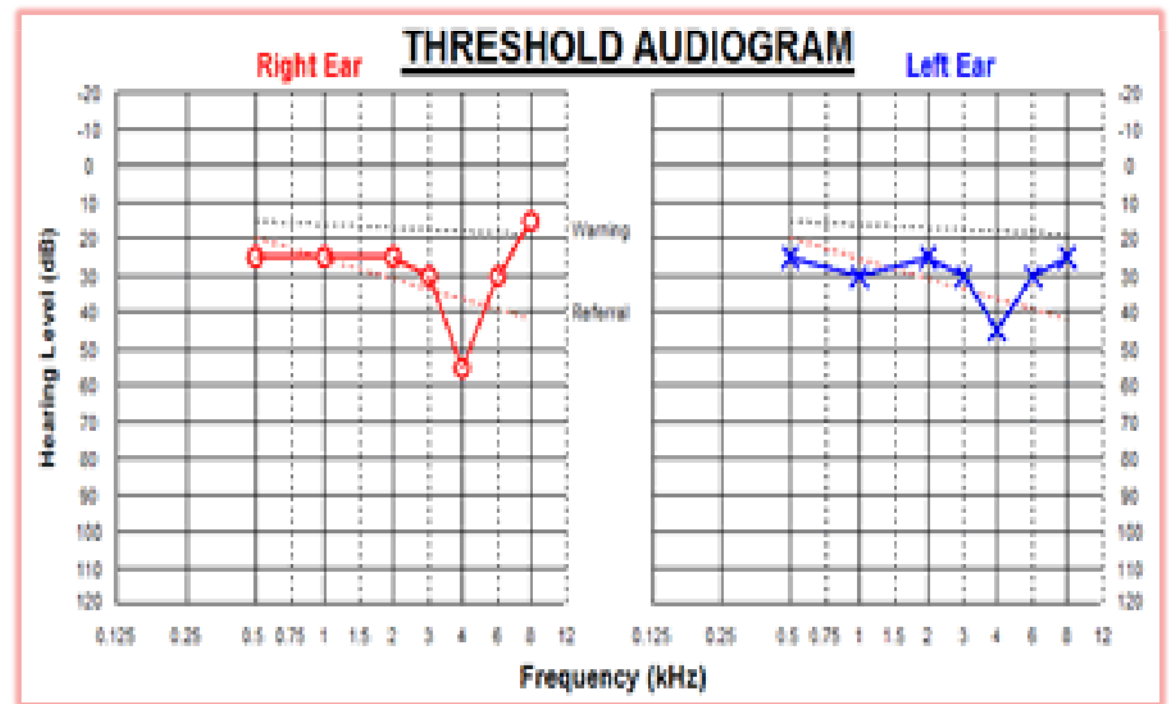
According to ANSI, any unwanted sound is known as noise

Permissible Level Of Noise
(Continuous Noise)

Duration /day in Hr	Sound Level(dBA)
8 Hrs.	90
6 Hrs	92
4 Hrs.	95
3 Hrs.	97
2 Hrs.	100
1 Hrs.	105
½ Hrs	110
¼ Hrs.	115
1/3 Hrs.	-

Permissible Level of Noise (Impulse Noise)

Noise in dBA	Impulse per day
140	100
135	315
130	1000
125	3160
120	10,000



Characteristics of NIHL

1. Gradual
2. Painless
3. Bilateral
4. Preventable at initial stage
5. In early stage speech range is not affected
6. Hearing loss can be measured
7. It depends on individual susceptibility
8. It usually starts at 4000 Hz.
9. It gradually expands to upper & lower frequency range
10. It is not amenable to treatment
11. It is S.N type of deafness
12. Irreversible



Ear Muff



Ear Plugs

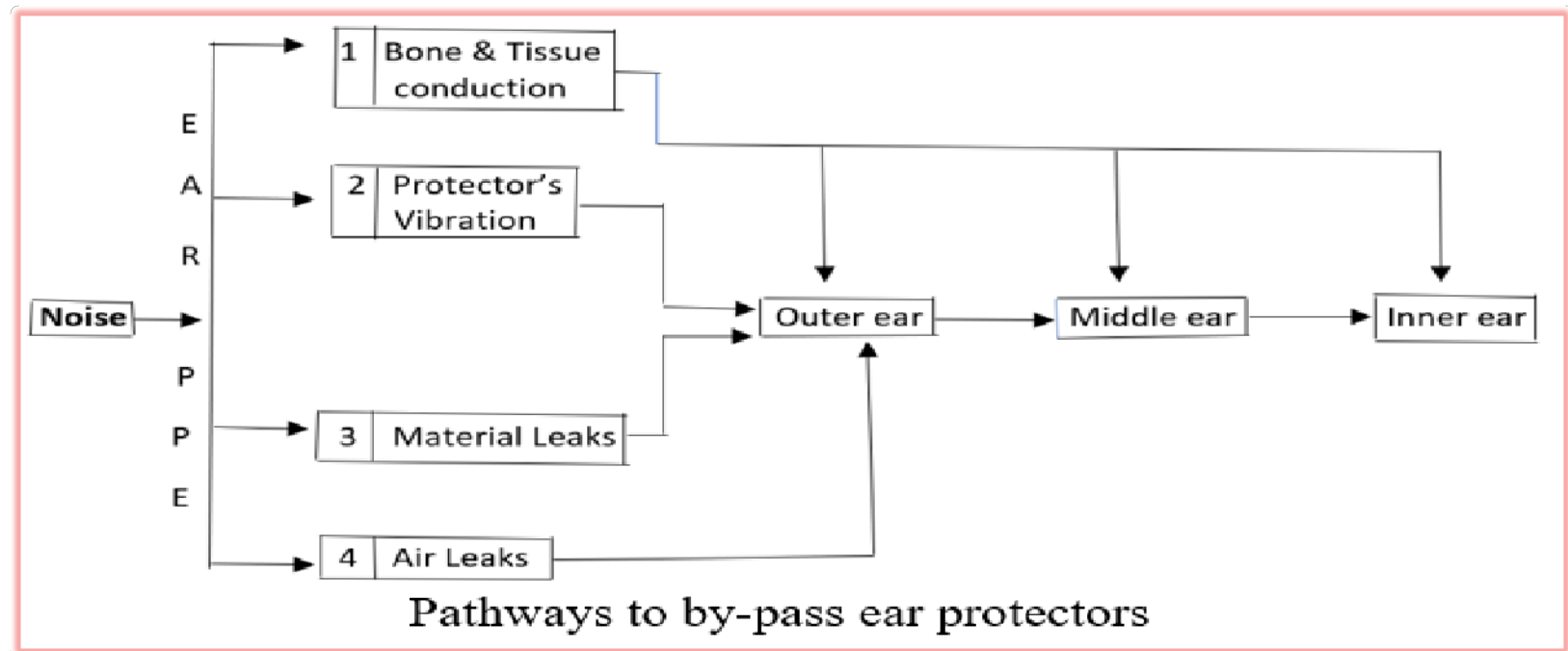
Net Reduction Rate (NRR)

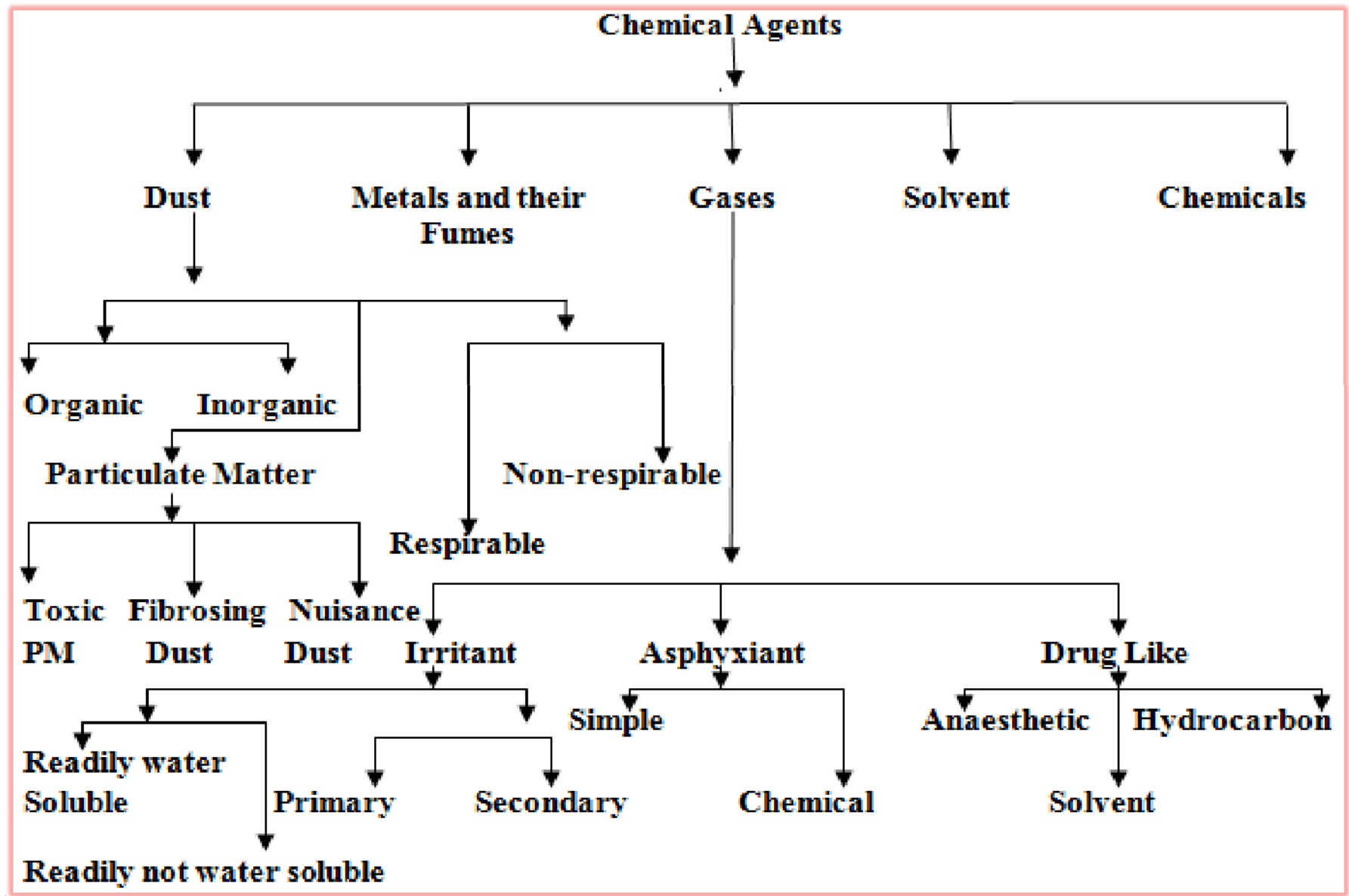
The 50# safety factor adjusts labeled NRR values for workplace conditions and is used when considering whether engineering controls are to be implemented.

Estimated dBA exposure = $98 \text{ dBA} - [(25-7) \times 50\#] = 89 \text{ dBA}$

However, when assessing the adequacy of the hearing protection for hearing conservation (HC) purposes, CSHOs should only subtract 7dB from the NRR.

Exposure for PPE/ HC enforcement = $98 \text{ dBA} - (25-7) = 80 \text{ dBA}$





Dermatitis



Oil Acne



Occupational Lung Disease

Damage to the lungs caused by dusts or fumes or noxious substances inhaled by workers in certain specific occupations are known as Occupational Lung Disease

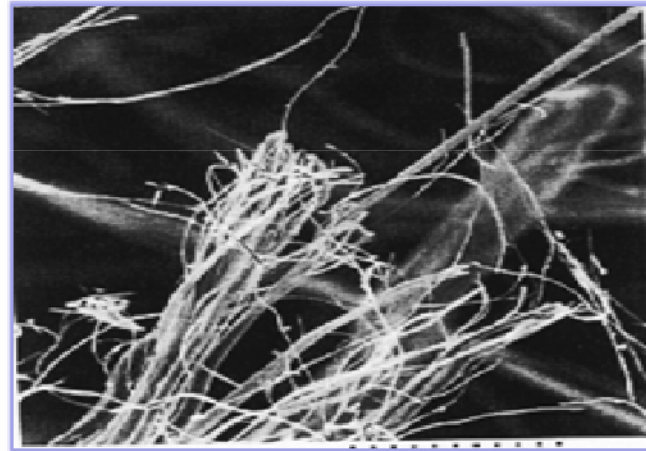
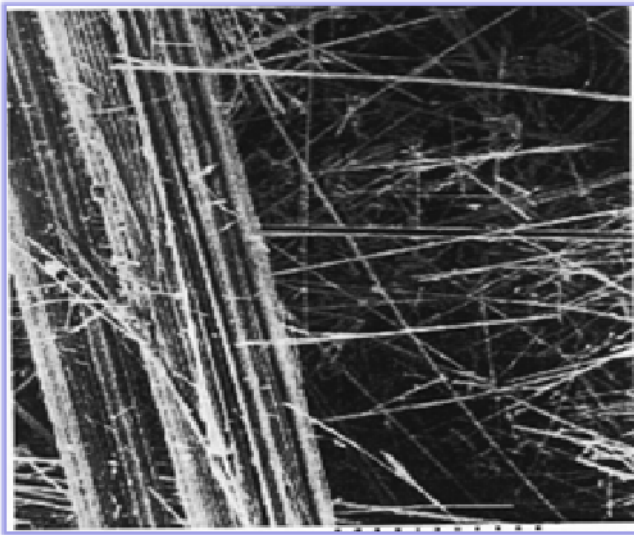
Pneumoconioses

- Lung diseases caused by inhalation of fine dust particles and the reaction of the lungs to the dust
- Pneumoconiosis is defined as the non-neoplastic reaction of the lungs to inhaled mineral or organic dust in various occupations and the resultant alteration in their structure, excluding asthma, bronchitis and emphysema.

Asbestosis

Asbestosis: caused by bio-persistent, durable mineral fibers, most commonly chrysotile, amosite, or crocidolite asbestos

Chrysotile or *white asbestos*-- the serpentine group

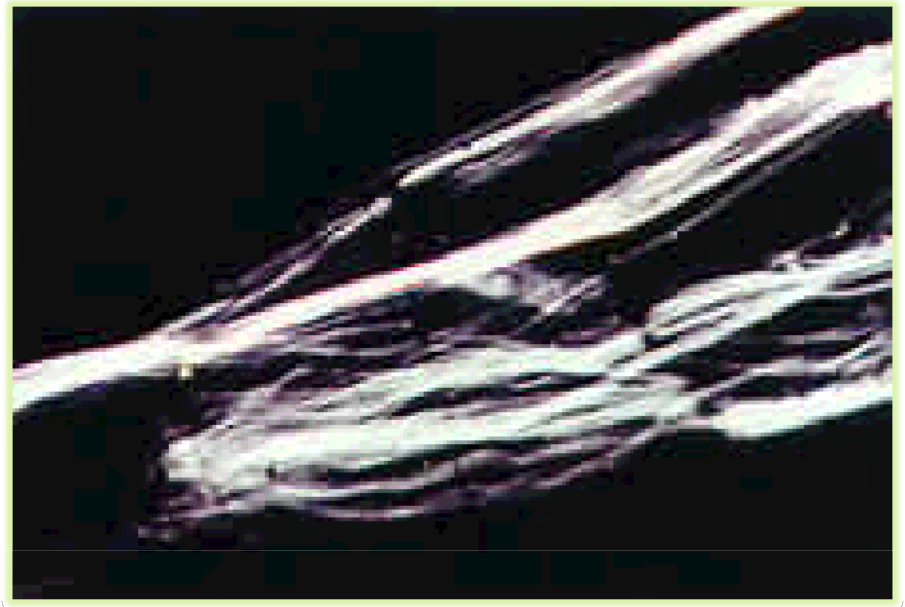


Amphibole group amosite or *brown asbestos*, crocidolite or *blue asbestos*

BLUE ASBESTOS



WHITE ASBESTOS



Asbestos Mines



ASBESTOS

- roof tile(slate)
- brake pad
- Asbesto
- s cement
- textile
- packing
- tape
- blanket(fire-proof)



Ship Breaking Unit



Asbestos Waste

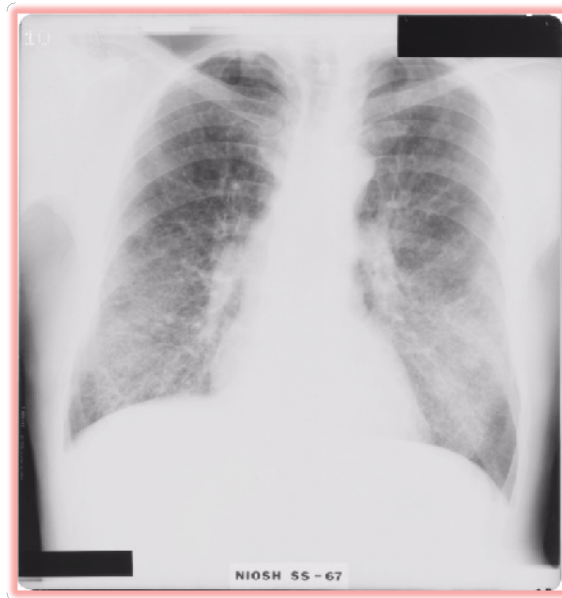


ASBESTOS RELATED DISORDERS

- 1). Asbestos bodies in the sputum
- 2). Transient Pleural Effusions
- 3). Pleural Plaques and Pleural Thickening

ASBESTOSIS	DOSE DEPENDENT	15 + yrs	PREVENTABLE
LUNG -CANCER	Dose dependant +SMOKING MULTIPLES	20 + yrs	„
MESOTHELIOMA	BLUE FIBRE	30 + yrs	„

Asbestosis

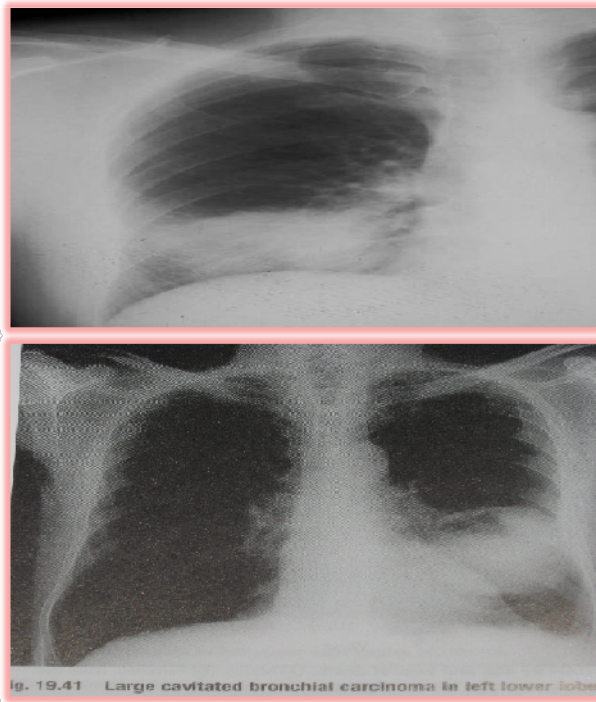


Ferruginous Bodies

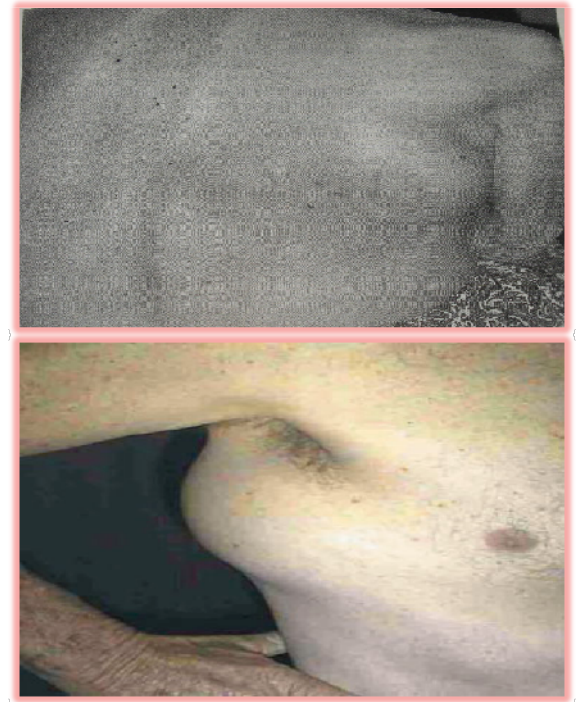
Not all ferruginous bodies are asbestos mineral at the core
Coating around other minerals such as iron, talc, and glass



Asbestos Lung Cancer

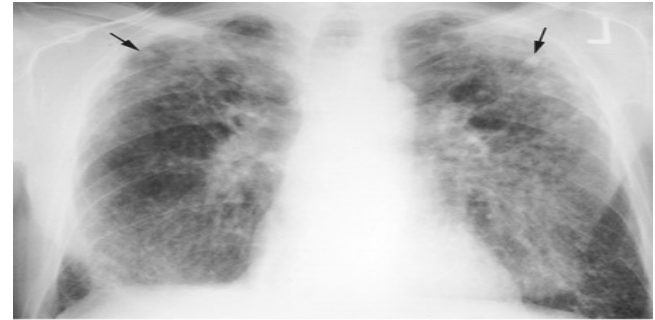


Mesothelioma



SILICOSIS

Silicosis is a fibrotic disease of the lung caused by the inhalation of, retention of and pulmonary reaction to crystalline silica.



Agate industry

Vertical grinding



Raw material

Horizontal grinding

Final product

Construction Industry is one of India's largest employers

Growing at a rate of 15 percent a year

It employs 30 million workers, of which over 30% are women

Conservative estimates of women workers would put the number of children at sites in millions



PROCESS IN SLATE PENCIL INDUSTRY



Stacks of raw material

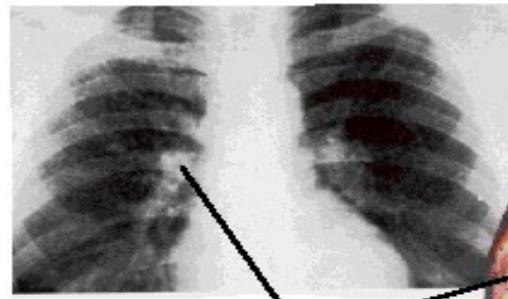
Removing sheets with chisel

Removing sheets with chisel

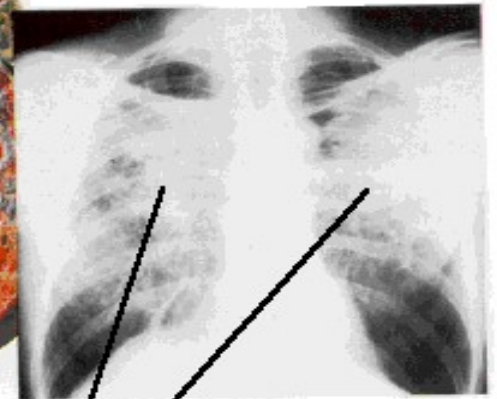
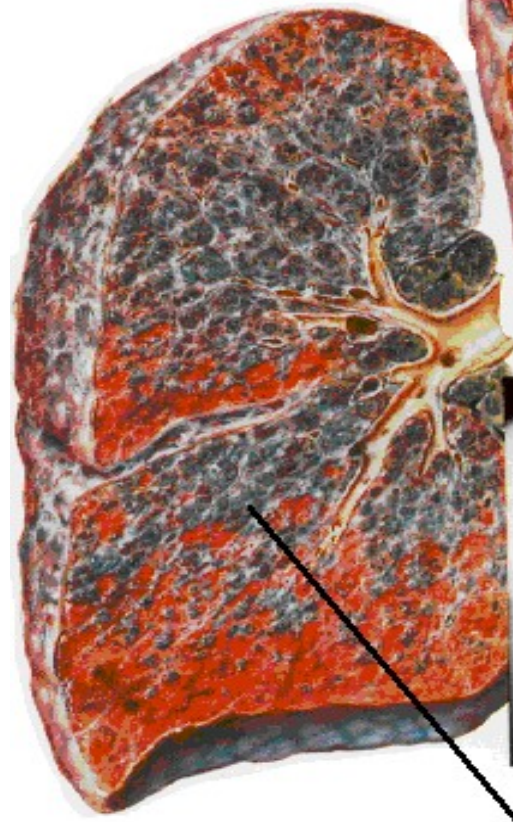
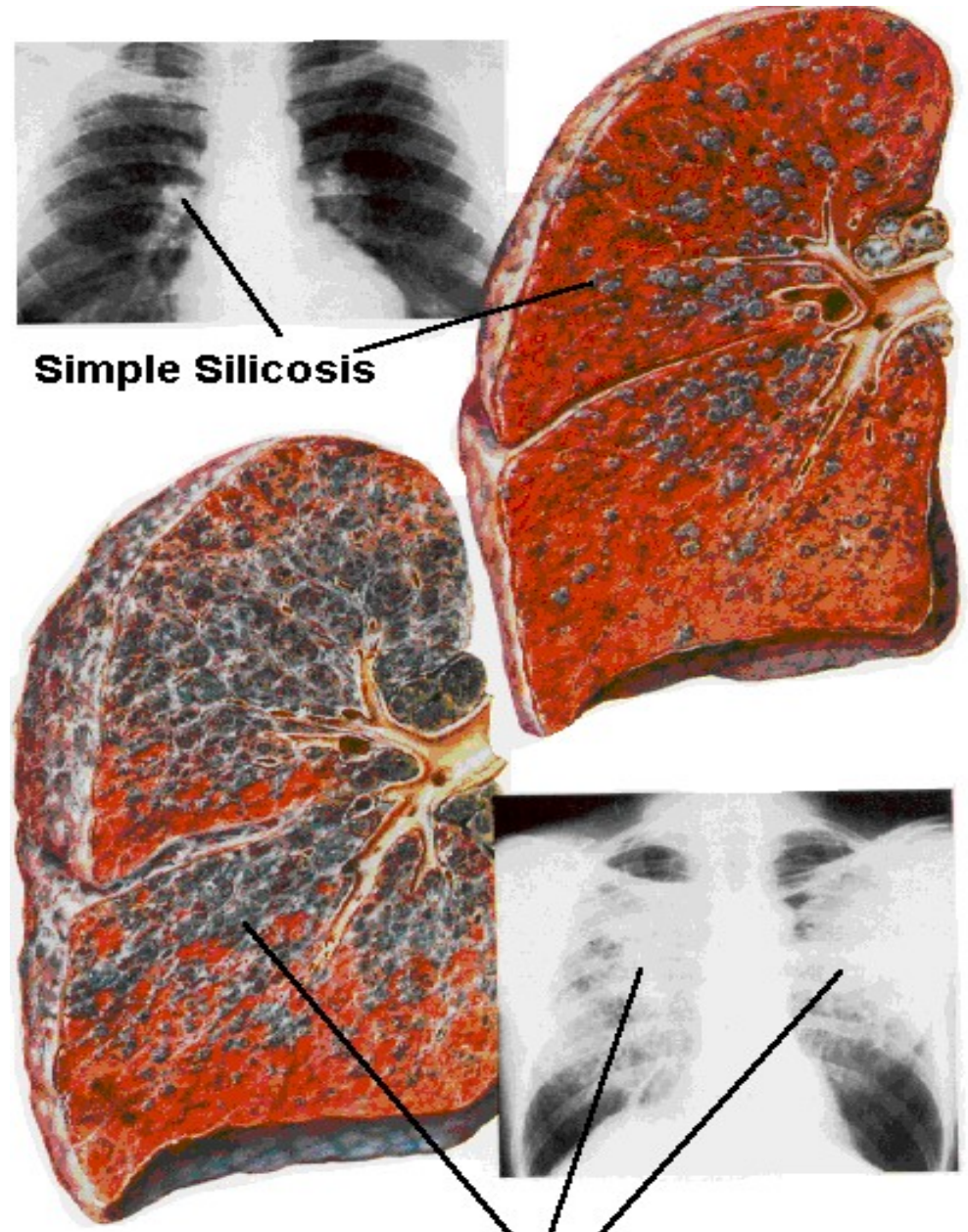
Removing sheets with chisel

What Does Silicosis Look Like?

- Simple Silicosis
 - Small discrete nodules (lesions)
- Complicated Silicosis
 - Lesions increase in size
 - Grow together to form larger masses



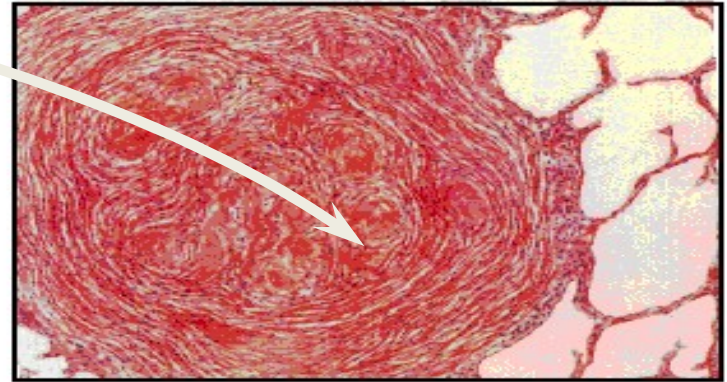
Simple Silicosis



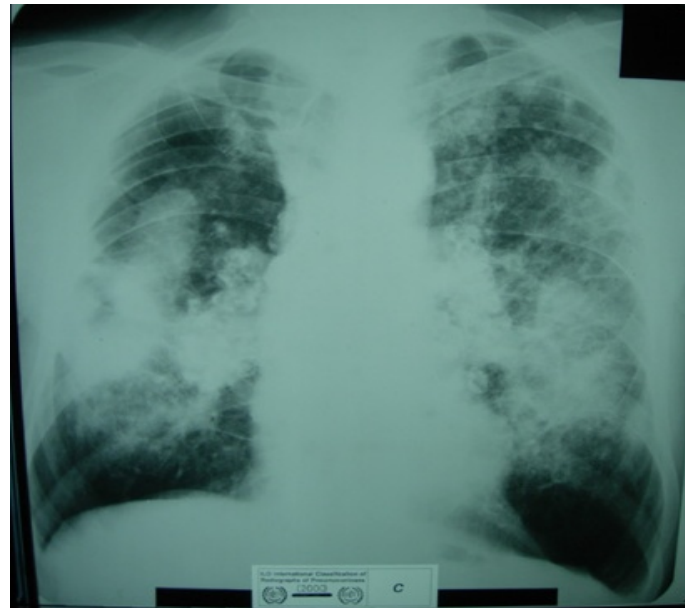
Complicated Silicosis

Typical Silicosis Nodule

- Fibrotic Scar Tissue
Unable to pass oxygen or carbon dioxide
- Concentric (“onionskin”) whorled pattern



PMF



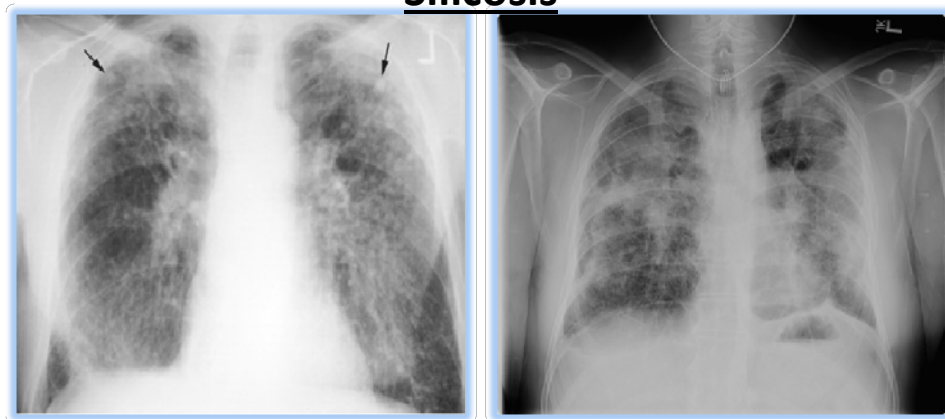
FOLLOWING INDUSTRIAL WORKERS ARE AT RISK THEIR & PREVALENCE (INDIA)

Industry	Prevalence%	Reference
Gold Mines	13.9	Gowda(1983)
Mica Mines/Processing	5.2	Ganguli et al(1993)
Slate Pencil	54.6	Sayed et al(1984)
Ceramics & Potteries	15.1	Sayed et al(1995)
Quartz Crushing	12.0 33.5	NIOH(1982) NIOH(2000)
Stone Cutters	20 25 35.2	Saini et al(1984) Sethi & Kapoor(1982) Gupta et al(1972)
Fe Foundries	27.2	Samal et al(1986)
Agate Workers	38	Sadhu et al(1985)
Glass Bangle Workers	7.3	Srivastav et al(1988)
Sand Grinding	27.8	NIOH(1989)

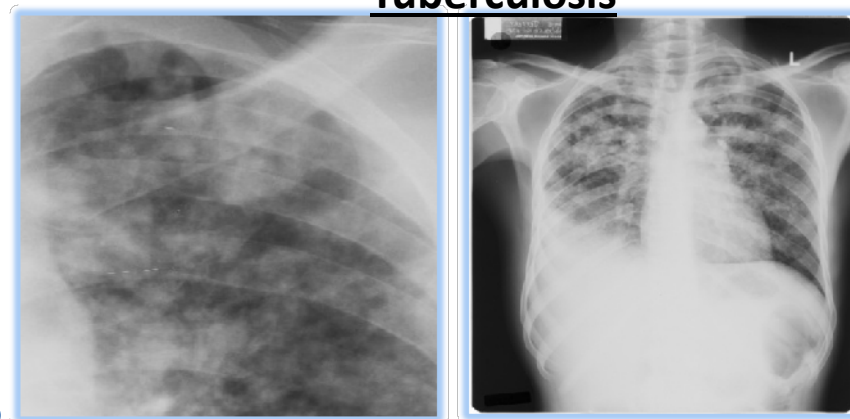
Silicosis vs Tuberculosis

Sl. No.	<u>Silicosis</u>	<u>Pulmonary TB</u>
1.	Primary Complex absent	Primary Complex present
2.	Symmetrical opacities in both lung fields	Asymmetrical opacities in both lung fields
3.	Soft patchy/moist shadow absent	Soft patchy/moist shadow present
4.	Egg-shell hillers lymph node present	Egg-shell lymph node absent
5.	Pleural Effusion absent	Pleural Effusion present
6.	Fibrosis of lung parenchyma is more	Lung parenchymal fibrosis is less
7.	Possibility of cavitation is less except PMF	Possibility of cavitation is more with sometime feature of mycetoma

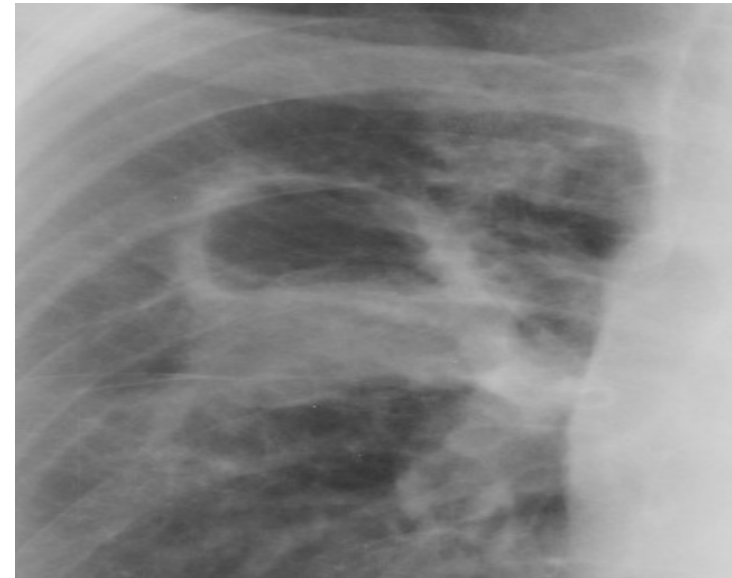
Silicosis



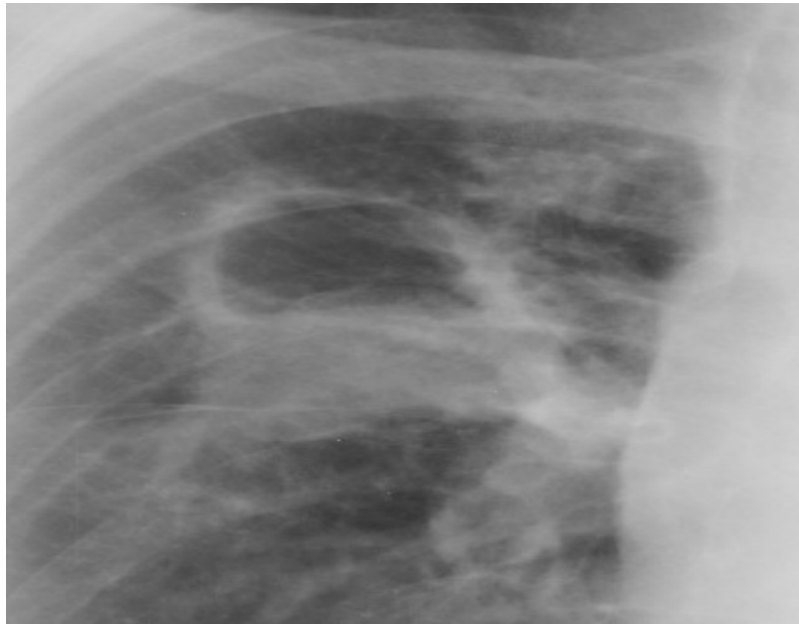
Tuberculosis



Cavitation



Tuberculous cavity



Fungal Ball (Mycetoma) in Cavity

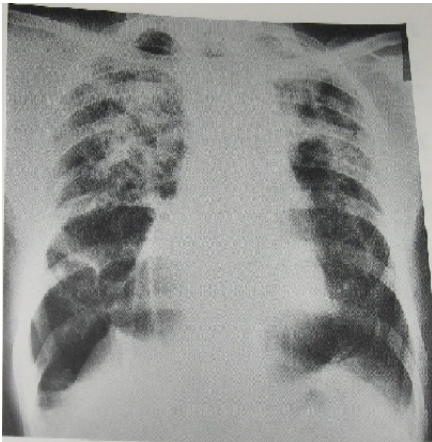


Stone Breaking Industry

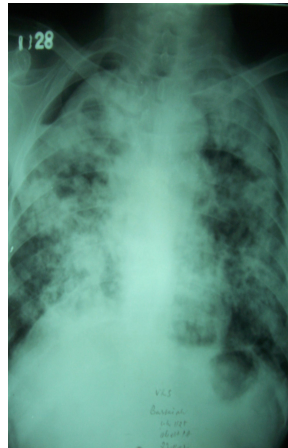


Total number of workers covered	Total number of silicosis cases detected	Prevalence Rate
83	12	14.45%

Mixed Dust Fibrosis



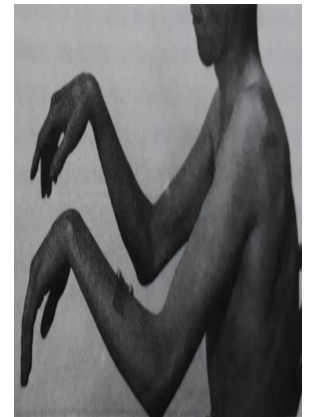
CWP



**Coal Workers'
Pneumoconiosis**



**Inorganic Lead
Poisoning**



TEL Poisoning (n = 23)

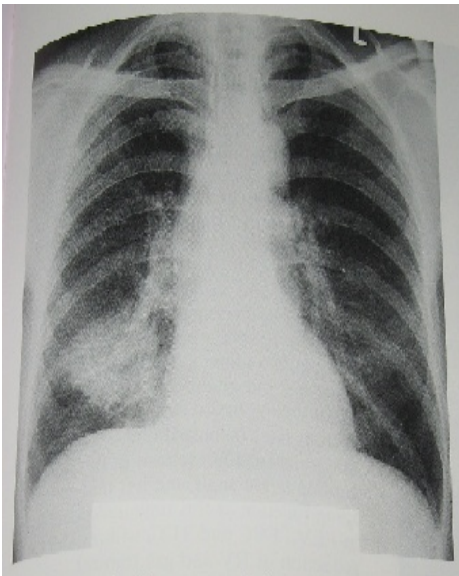
Urine Lead(Micr.g./L)

300
400
150
350
250
500
300
150
200
300

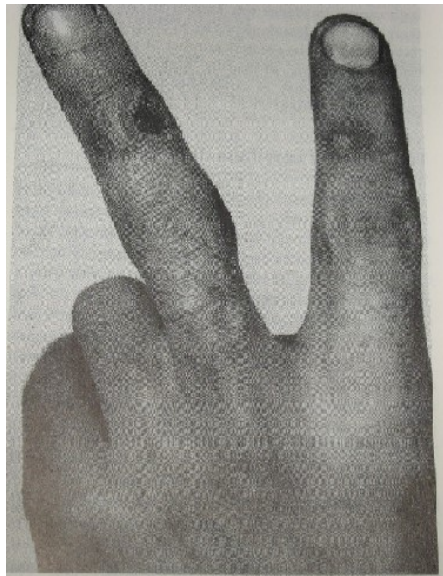
Blood Lead(Micr.g./dl)

80
50
80
50
50
50
50
60
60
50

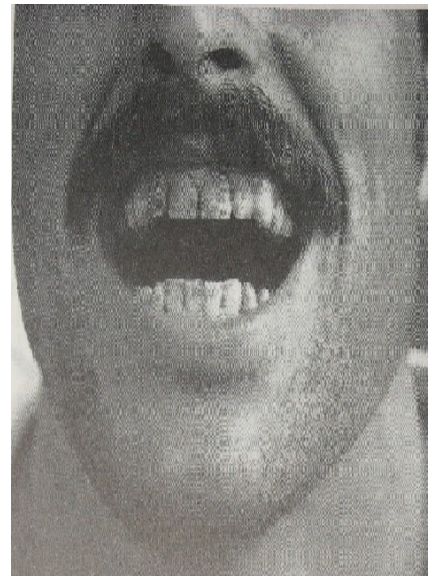
Lipoid Pneumonia
(Paraffinoma)



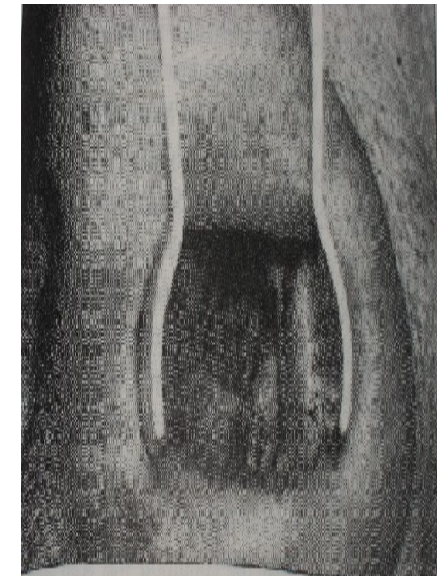
Chrome
Hole



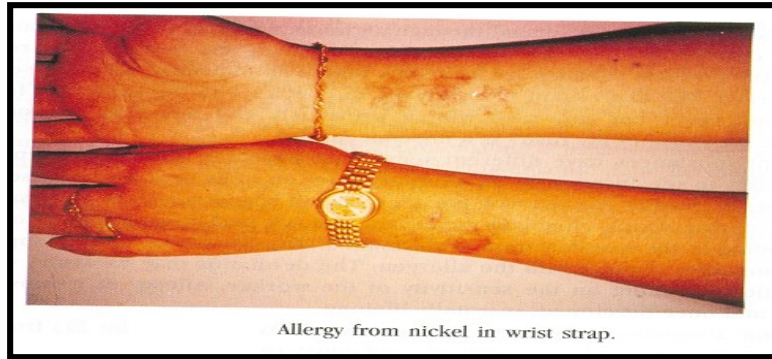
Dental
Fluorosis



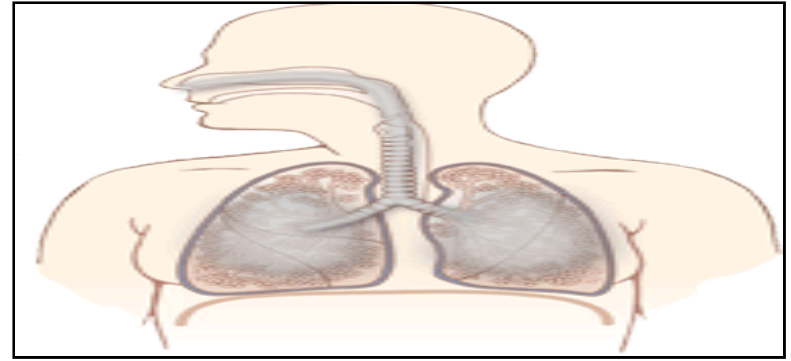
Nasal Septal
Perforation



Nickel Itch/Rash

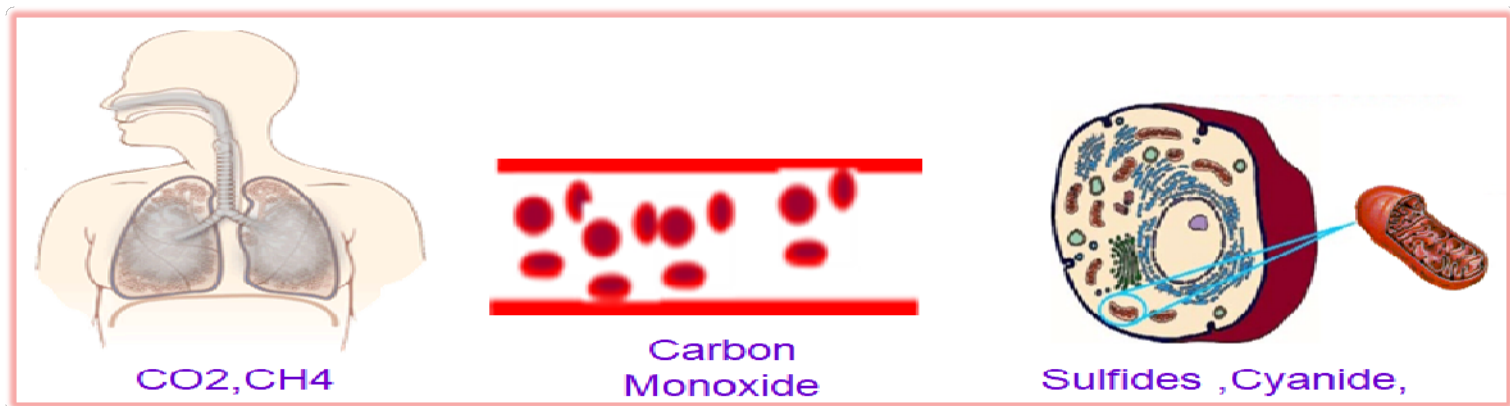


Simple Asphyxiants



Chemical Asphyxiant

Carbon monoxide : It is one of the most insidious of the poisonous gases encountered in the oil industry. It is known as silent killer because it is colorless, odorless, tasteless, and non-irritant. It is produced in the burning of carbon containing material whenever the supply of air is not sufficient for complete combustion.



Toxico-Dynamics of Irritant Gases

Ammonia; Formaldehyde;
Hydrogen chloride; Sulfur
dioxide

Chlorine

Phosgene; Nitrogen
dioxide

Highly Soluble

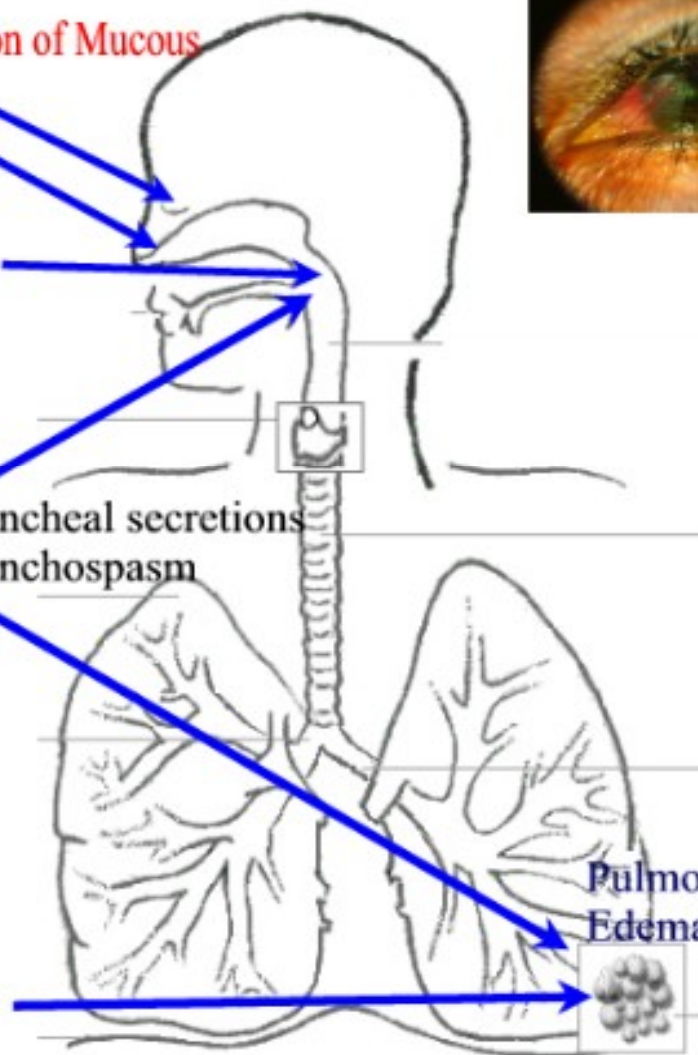
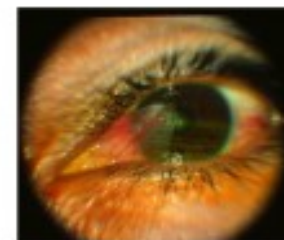
Moderately Soluble

Sparingly Soluble

Irritation of Mucous
Eyes
Nose
Throat

Broncheal secretions
Bronchospasm

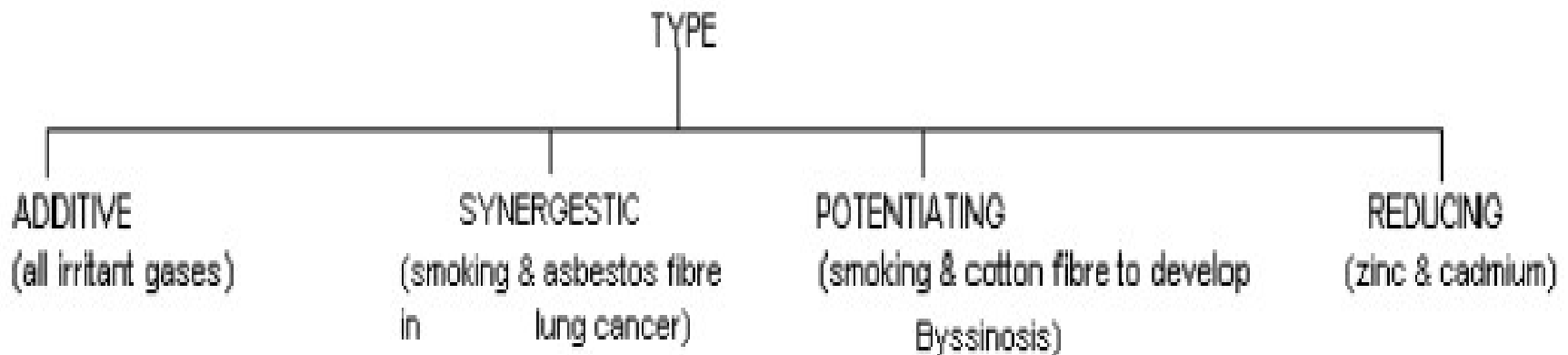
Pulmonary
Edema



CLINICAL MANIFESTATIONS OF IRRITANT GASES DUE TO LOCAL EFFECTS

- Local corrosive effects of highly soluble irritants: Inflammation of eyes, nose and throat, hoarseness or loss of voice (due to swelling of voice box).
- Difficulty in breathing, cough and excess sputum, chest tightness (Broncheal secretion/spasm).
- Damage of type I pneumocyte → Leaking of fluid in alveolar space → Oedema lung
- Damage of type II pneumocyte → ↓ Surfactant → Collapse of alveoli → Atelectasis

CHEMICAL INTERACTION & ITS EFFECT ON HUMAN BODY



C. BIOLOGICAL AGENTS

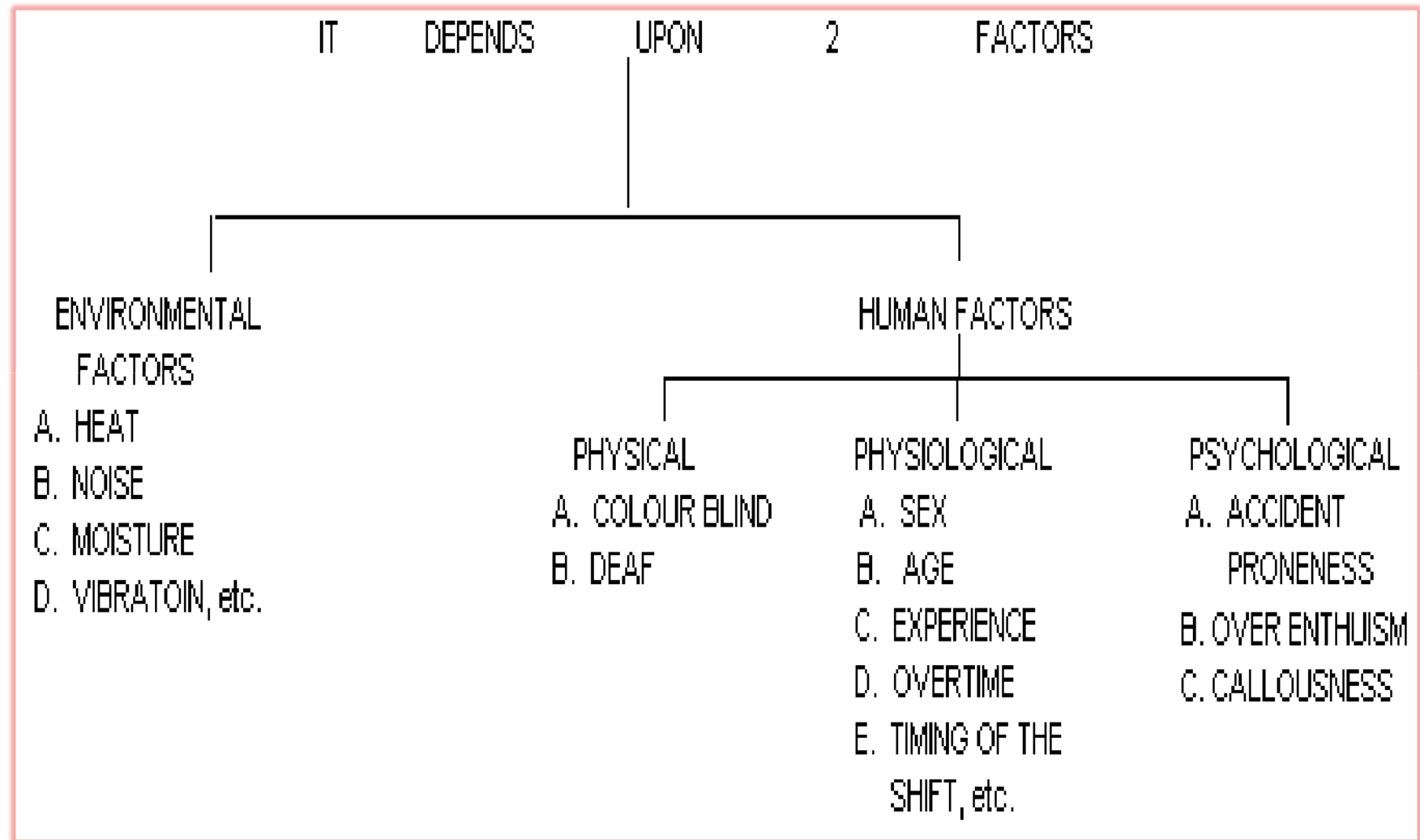
- BACTERIA
- VIRUS
- FUNGUS
- PROTOZOA
- ANIMALS

e.g. rat bite, cat bite, snake bite, dog bite

Cutaneous Anthrax



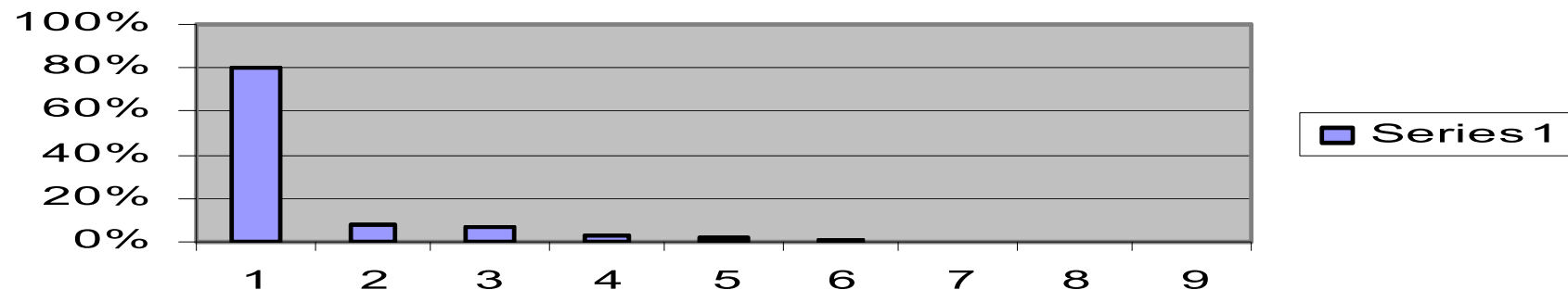
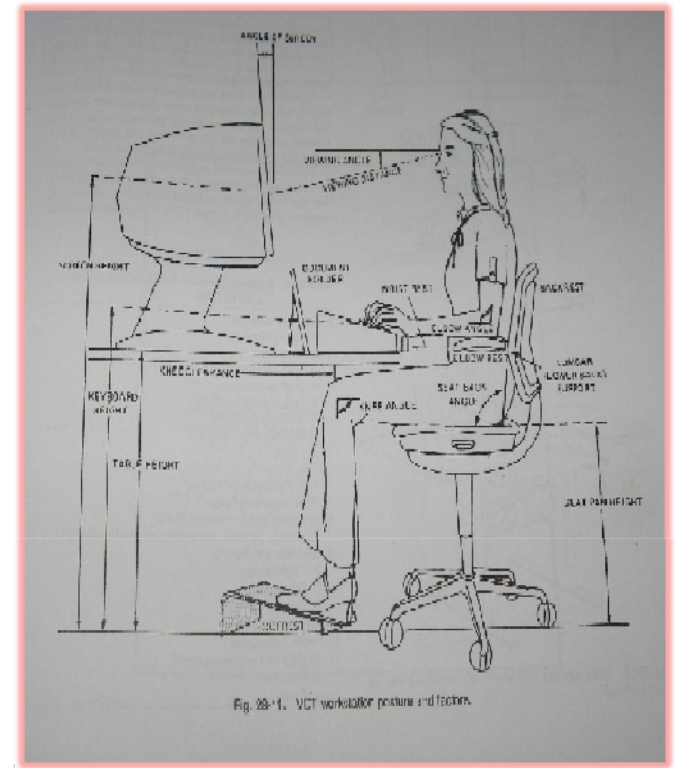
D. MECHANICAL HAZARD - causes accidents & injuries



EYE INJURIES

The eye injuries account for about 5% of all ind. Injuries. They are caused due to :

•FLYING OBJECTS	:	80%
•TOOLS OR PARTS OF MACHINES	:	8%
•SPLASHES OF LIQUIDS	:	7%
•EXPLOSIVE	:	2.5%
•FALLS	:	2%
•INFECTIONS	:	0.5%

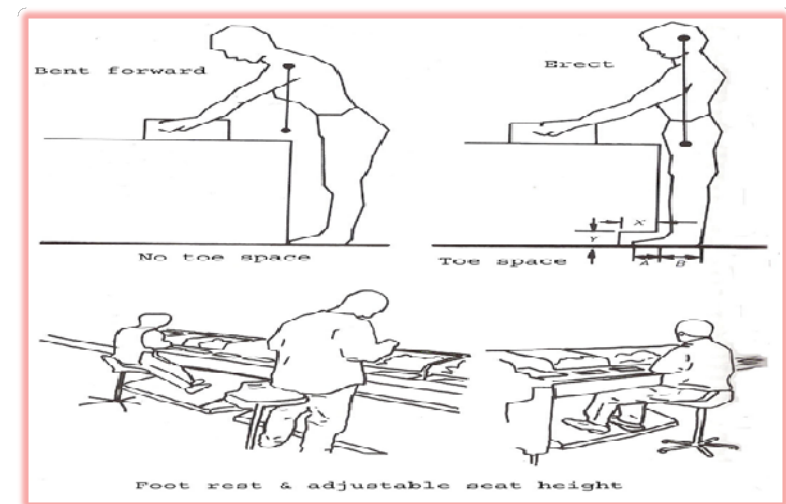
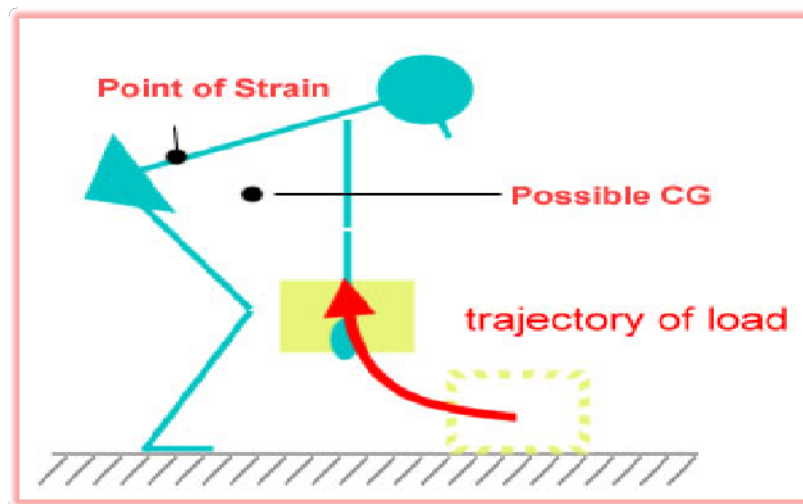


STD/CTD

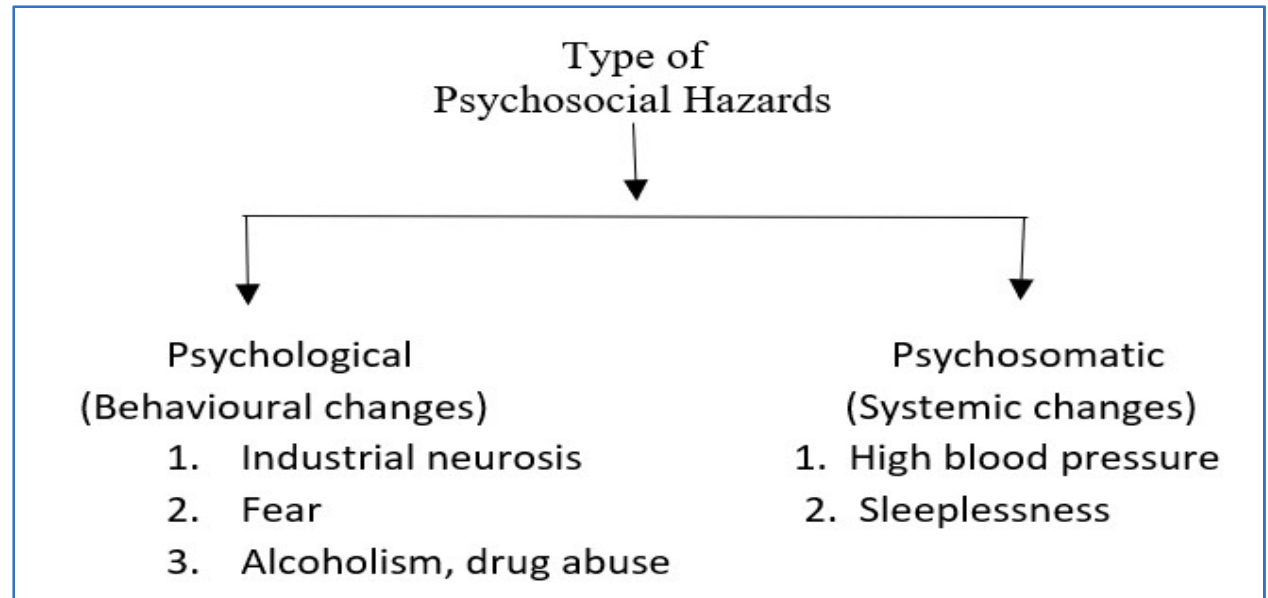
Any situations where the works have not been designed ergonomically, the workers may suffer from Sustained Trauma Disorders like eye pain, eye fatigue, wrist pain, low back pain etc.

Work-Related Musculoskeletal Disorders

Musculoskeletal disorders are the problem and ergonomics is a solution.



E. Psychosocial Hazards



PREVENTIVE HEALTH CARE

It means the formulation and implementation of long term policies and measures to mitigate the impact on Health

Levels of Prevention

- Primordial Prevention
- Primary Prevention
- Secondary Prevention
- Tertiary prevention

Primordial Prevention

Prevention of the risk Factor: exam.

Relative Risk for Lung Cancer of Smoker = 10

Relative Risk for Lung Cancer of asbestos Worker = 5

Relative risk for both in one person for Lung Cancer = 60

Primary Prevention

- **Health Promotion & Specific Protection:**

health promotion is the process of enabling people to increase their control over their own health and to improve it. Health promotion can be seen as a continuum ranging from prevention, including protection against specific risks, to the promotion of optimal health. In a broader sense it also includes the encouragement of all aspects of positive health.

Secondary Prevention

- **Early Diagnosis, and**
- **Treatment**

Tertiary Prevention

- **Disability Limitation, and**
- **Rehabilitation**

Preventive Measures

- 1. Medical Measure**
- 2. Safety Measure**
- 3. Statutory/Legislative Measure**
- 4. Administrative Measure**

MEDICAL MEASURES

➤ MEDICAL EXAMINATIONS

1. Pre-employment
2. Periodical
3. Pre-placement
4. Pre-retirement
5. Special

➤ NOTIFICATION

MEDICAL MEASURE (contd.)

➤ MEDICAL & HEALTH CARE SERVICE

- 1. FIRST AID BOXES**
- 2. FIRST AID CENTRE**
- 3. HOSPITAL**
- 4. OCCUPATIONAL HEALTH SERVICE**

➤ ENVIRONMENTAL MONITORING

Pre-employment Medical Examination

The main purpose of Pre-employment Medical Examination is to place the right person in the right job.

<u>HAZARDS</u>	<u>UNDESIRABLE CONDITION</u>
a) Lead	Anaemia, hypertension, nephritis, peptic ulcer.
b) Dyes	Skin, bladder & kidney diseases, asthma, pre-cancerous lesion.

Periodical Medical Examination

The main purpose of PME is to detect the occupational diseases in the early stage.

Audiometric Test



Medical Record Keeping



First Aid Appliances and OHC



First-Aid Treatment



FIRST RESPONDER CRITICAL CARE AMBULANCE



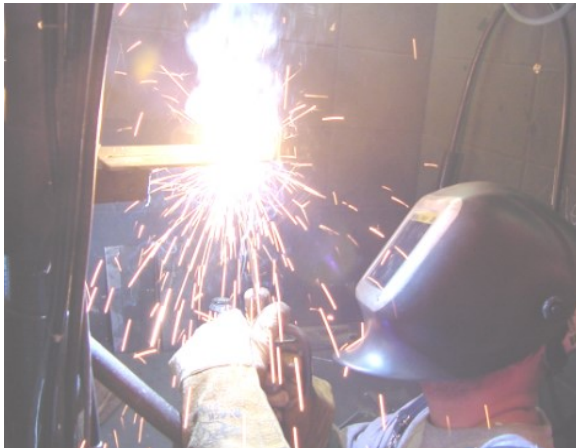
Occupational Health Service

OHS ARE HUMAN-SERVICE ORGANIZATIONS IN MODERN SOCIETY WHICH HAVE BEEN DESIGNED TO MANAGE AND PROMOTE THE SAFETY, HEALTH, AND WELFARE OF CITIZENS AT WORKS.

Principles:

- a) preventive
- b) promotive
- c) protective
- d) adaptation
- e) cure & rehabilitation
- f) primary health care

PROTECTION PRINCIPLE



MEASURES FOR IMPROVING WORKERS' NUTRITION



Acclimatization as Adaptation



Notice of certain Diseases-

The main purpose of notification in industry is to initiate measure for prevention and protection and ensuring their effective application and to investigate the working condition and other circumstances which have caused or suspected to have cause occupational diseases.

SUPERVISION OF WORKING ENVIRONMENT

Work Environment



Dust Monitoring



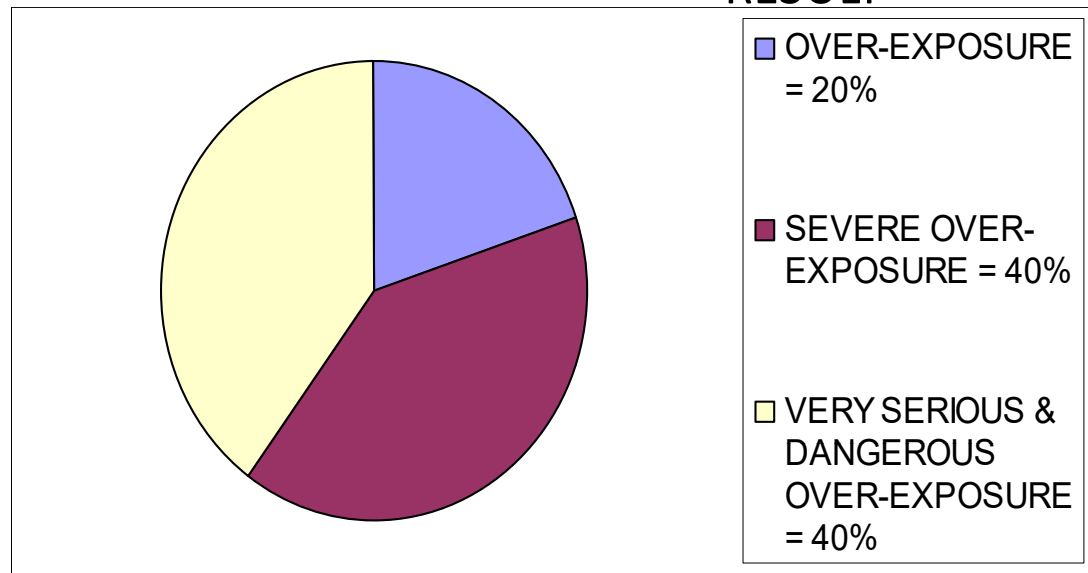
Biological Monitoring

It is a standard preventive measure in the practice of industrial health and environmental safety

STUDY REPORT

CHOLINESTERASE ACTIVITY IN BLOOD IN AN ORGANOPHOSPHATE PESTICIDE PLANT

- 100 – 75% : **NORMAL**
- 75 – 50% : **OVER EXPOSURE**
- 50 – 25% : **SEVERE O.E.**
- 25 – 0% : **VERY SERIOUS
& DANGEROUS
O.E.**



Biological Monitoring & Environmental monitoring

In combination constitute a promising step towards an integrated exposure monitoring for health risk assessment

ENGINEERING MEASURES

- DESIGN OF BUILDING
- GOOD HOUSEKEEPING
- GENERAL VENTILATION
- MECHANIZATION
- SUBSTITUTION
- DUST CONTROL
- ENCLOSURE
- ISOLATION
- LOCAL EXHAUST VENTILATION
- PROTECTIVE DEVICES
- ENVIRONMENTAL MONITORING
- STATISTICAL MONITORING
- RESEARCH

Mechanization



Manual



FIBRE HANDLING & PROCESSING INSIDE THE PLANT



Bag Cutting Inside/ Bag Opener Inside

ENCLOSURE: SANDBLASTING



FIBRE STORAGE AREA --- MAINTENANCE



Vacuum Cleaning

WASTE RECYCLING

Broken sheet recycling



Process sludge recycling



Wet Method



Local Exost Ventilation



Isolation from Noise Hazard

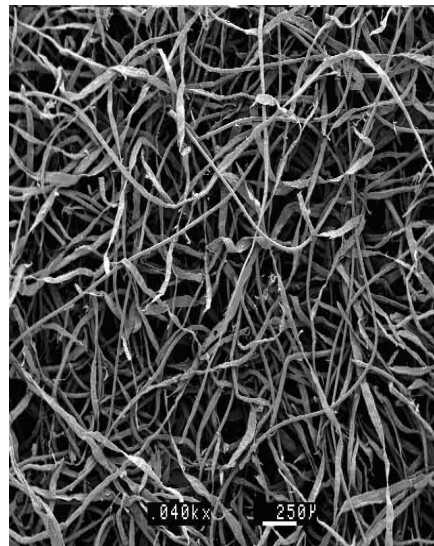


Substitution of Asbestos Fibre

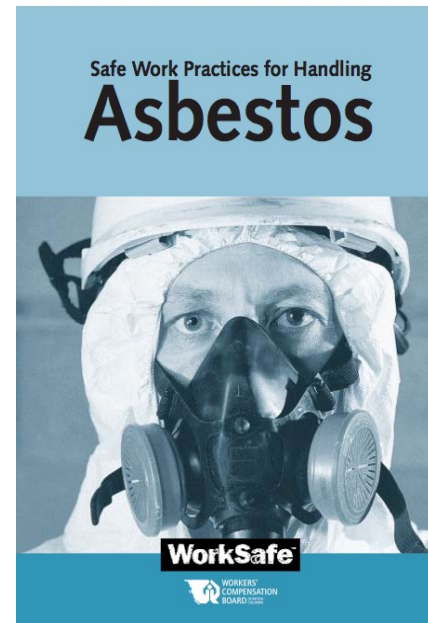
PVA Fibre



Cellulose Fibre



Personal Protective Equipment



PPE use during asbestos removal

Preventive Health Care Training Program

- To upgrade knowledge & skill.
- To renew the attitudes of the people and to bring about a positive, safe & healthy work culture.
- To implement the concept of work place health promotion.



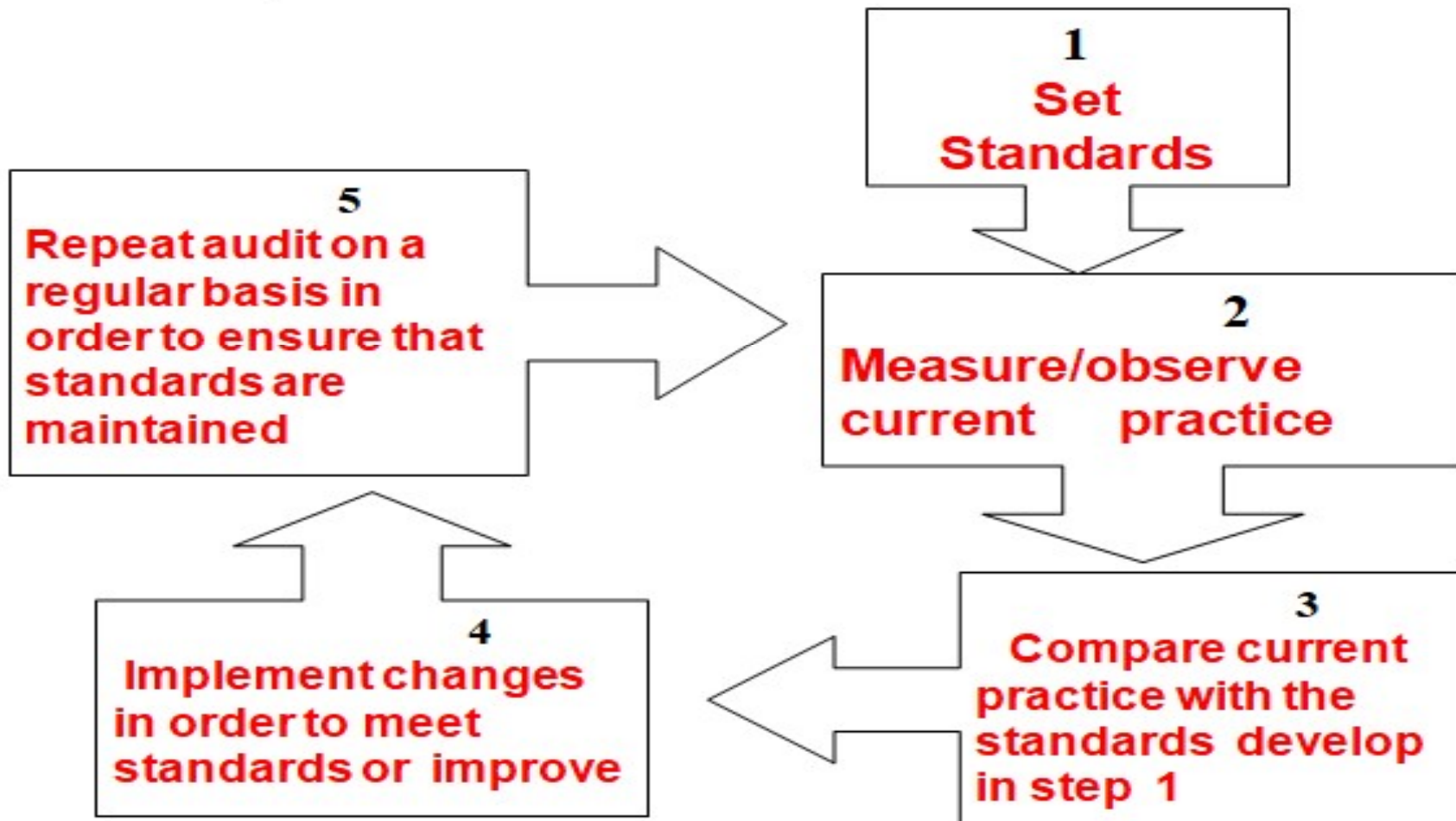
SOME OCCUPATIONAL HEALTH DEPARTMENTS HAVE ADOPTED THE ISO-9000 / BS-5750 APPROACH AND HAVE INCORPORATED ELEMENTS OF MEDICAL AUDIT INTO QUALITY SYSTEM.

BIS-14489 HAS INCORPORATED THE OCCUPATIONAL HEALTH AUDIT INTO OCCUPATIONAL SAFETY AUDIT AND RENAMED AS OCCUPATIONAL SAFETY & HEALTH AUDIT.

Objectives of Occupational Health Audit

- To determine the effectiveness and efficiency of an OHS organization as a whole.
- To determine the need of change e.g. in policy and in other planning and to evaluate any changes implemented.
- To determine compliance with a standard, or with a service level agreement in terms of the structure of services, the quality of their process and/or the effectiveness of outcome.
- To find gaps in the evidence base for current practice, for setting the agenda for further research, evaluation and hence wider improvements in quality.

Donabedian's Model



The common model for occ. health audit

Ergonomical Intervention

Ergonomics is now a well recognized discipline & constitutes an integral part of advanced Occupational Health Service. It simply means “fitting the job to the workers”. The objective of ergonomics is “to achieve the best mutual adjustment of man and his work, for the improvement of human efficiency and well-being”.

OCCUPATIONAL HEALTH HAZARDS & ITS PREVENTION IN PROCESS INDUSTRY



THANK YOU!

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