OCCUPATIONAL HEALTH CONSIDERATIONS

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• Occupation and Health are closely inter-related.
• Occupation can affect man’s health and vice-versa.
• There is no known occupation devoid of risk.
Occupational Health is the application of preventive medicine in all places of employment; the purpose is to protect and promote the health of all employed persons.
The highly complex work environment encountered in the industries necessitates constant vigilance through occupational health program, to provide a scientific basis for decisions aimed at protection of human health from the consequences of adverse exposure to hazards in the work environment.

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Occupational medicine first emerged as a specialist discipline in response to occupational exposure to chemical, physical and biological hazards resulting in adverse health effects on workers. contd..
The adverse health effects on workers, ranging from simple irritation and discomfort to debilitating diseases such as lung fibrosis, neuropathy, deafness, organ damage and cancers of various sites etc. contd..
WORK-RELATEDNESS OF HEALTH AND DISEASE

Work related diseases fall into three broad categories - those in which work
• is a necessary cause.
• is a contributory cause, and aggravates an established disease.
• provokes a latent disorder

contd..
The focus is now shifted to work related etiologic fractions of many diseases with multiple etiology such as reproductive health, chronic non specific respiratory diseases (CNRD), neuro-toxicity, mutagenesis, carcinogenesis etc. contd..
The petroleum industry operates in the midst of potential health hazards. Occupational exposure to *gases, complex mixture of hydrocarbons, other chemicals, high noise level, heat stress* etc. are encountered in the industry.
REFINERY PROCESSES

Petroleum refineries are a complex system of multiple operations and the operations used at a given refinery depend upon the properties of the crude oil to be refined and the desired products. For these reasons, no two refineries are alike.

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REFINERY PROCESSES

The refinery processes are closed systems and exposures to hazards are expected to be minimal under normal operating conditions.
REFINERY PROCESSES

However there is potential for exposure to hazards -

• if a leak or release occurs,
• during process sampling, inspection,
• maintenance, and
• turnaround activities.

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CRUDE OIL PRETREATMENT (DESALTING)

Health considerations:
Potential for exposure to
• Hydrogen sulfide;
• ammonia;
• dry chemical demulsifiers, caustics, and/or acids;
• Heat

contd

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CRUDE OIL DISTILLATION
(FRACTIONATION)

Health considerations:
Potential for exposure to
• hydrogen sulfide;
• high boiling aromatic compounds including carcinogenic PAHs;
hydrocarbons (naphtha, benzene, hexane).

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THERMAL CRACKING, VISBREAKING, COKING PROCESSES

Health considerations:
Potential for exposure to
• Naphtha containing benzene;
• trace carcinogenic polynuclear aromatics;
• hydrogen sulfide,
• carbon monoxide.  contd.

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THERMAL CRACKING, VISBREAKING, COKING PROCESSES

• Coking process for exposure to burns;
• heat and noise;
• oxygen depletion in confined spaces (storage silos).

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CATALYTIC CRACKING PROCESS

Health considerations:
Potential for exposure to
• Carcinogenic PAHs,
• Naphtha containing benzene;
• Sour gas containing H2S and CO2 / CO.
• Particulates

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HYDROCRACKING PROCESS

Health considerations:
Potential for exposure to
• hydrocarbon vapor emissions;
• naphtha containing benzene;
• carcinogenic PAHs;
• Catalyst dust.

contd.

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HYDROCRACKING PROCESS

- hydrogen-rich gas,
- hydrogen sulfide gas;
- carbon monoxide;
- noise and heat;
Health considerations:
Potential for exposure to
• Sulfuric acid and (particularly) hydrofluoric acid;
• noise and heat.
Health considerations:
Potential for exposure to
• hydrogen gas,
• hydrochloric acid, and hydrogen chloride;
• dust when solid catalyst is used;
• noise and heat.
Health considerations:
Potential for exposure to
• caustic wash (sodium hydroxide);
• phosphoric acid;
• catalyst dust;
• noise and heat.
CATALYTIC REFORMING

Health considerations:
Potential for exposure to
• naphtha, benzene;
• hydrogen rich process gas,
• catalyst dust;
• carbon monoxide and hydrogen sulfide;
• noise and heat.

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Health considerations:
Potential for exposure to
• hydrogen sulfide;
• hydrogen gas;
• ammonia;
• phenol;
• noise and heat.
SOLVENT EXTRACTION AND DEWAXING

Health considerations:
Potential for exposure to
• extraction solvents such as phenol, furfural, glycols,
• mixture of MEK and toluene;
contd..
SOLVENT EXTRACTION AND DEWAXING

- PAHs;
- methyl ethyl ketone, amines; and other process chemicals;
- noise and heat.
SWEETENING AND TREATING PROCESSES

Health considerations:
Potential for exposure to
• hydrogen sulfide;
• caustic (sodium hydroxide), spent caustic,
• spent catalyst (Merox);
contd..

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Health considerations:
Potential for exposure to
• catalyst dust and sweetening agents (sodium carbonate and sodium bicarbonate);
• noise and heat.
AMINE PLANTS

Health considerations:
Potential for exposure to
• amine compounds such as monoethanolamine (MEA), diethanolamine (DEA) and methyldiethanolamine (MDEA);
• H2S & CO
• Noise and heat.

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SATURATED GAS PLANTS

Health considerations:
Potential for exposure to
•hydrogen sulfide, carbon dioxide;
•diethanolamine ;
•sodium hydroxide;
•noise and heat.

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SULPHUR RECOVERY & TAIL GAS TREATMENT

Health considerations:
Potential for exposure to
• hydrogen sulfide;
• Sulphur dioxide.
Health considerations:
Potential for exposure to
• polynuclear aromatics;
• hydrogen sulfide and sulfur dioxide;
• noise and heat.
HYDROGEN PRODUCTION

Health considerations:
Potential for exposure to
• hydrogen,
• carbon monoxide; and/or
carbon dioxide;
• noise and heat.

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BLENDING

Health considerations:
Potential for exposure to
• Additives, chemicals and benzene;
• noise and heat.
LUBRICANT, WAX, AND GREASE MANUFACTURING PROCESSES

Health considerations:
Potential for exposure to
• solvents – phenol, propane, MEK and toluene mixture, methyl isobutyl ketone;

contd.
LUBRICANT, WAX, AND GREASE MANUFACTURING PROCESSES

- hydrocarbon gases and vapours,
- aromatic naphtha containing benzene;
- hydrogen sulfide and hydrogen-rich process gas;
- noise and heat.
HEAT EXCHANGERS, COOLERS, AND PROCESS HEATERS

Health considerations:
Potential for exposure to
• hydrogen sulfide, carbon monoxide;
• hydrocarbons;
• water treatment chemicals;
• noise and heat.

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STEAM GENERATION

Health considerations:
Potential for exposure to
• feed water chemicals;
• steam, hot water,
• noise and heat.
Health considerations:
Potential for exposure to
• chemicals and waste products;
• gases;
• noise and heat
COOLING TOWERS

Health considerations:
Potential for exposure to
• sulfur dioxide, hydrogen sulfide, and carbon dioxide;
• Noise;
• water-treatment chemicals

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Health considerations:
Potential for exposure to

• Electricity;
• Noise
Health considerations:
Potential for exposure to
• Noise.
TURBINES

Health considerations:
Potential for exposure to
• Noise and heat
• Steam.

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The highly complex work environment encountered in the industries necessitates constant vigilance through occupational health program, to provide a scientific basis for decisions aimed at protection of human health.
Occupational health has Two complimentary disciplines –

i. Occupational Medicine.

ii. Occupational Hygiene.
i) **Occupational Medicine** is concerned primarily with occupational and work related illnesses. Contd.
ii) The study of exposure to occupational hazards has created a new field that of **occupational hygiene** which is concerned with man’s environment at the workplace.

contd..
OCCUPATIONAL HYGIENE

Qualitative & quantitative evaluation of environmental agents which pose health hazards at the workplace - in the concept of permissible threshold limit values (TLVs)

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TLV - TWA

The threshold limit value – time weighted average concentration for 8 hours a day and 40 hours a work week to which people can be repeatedly exposed day after day, without adverse health effect.

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Workers are often exposed simultaneously or successively to different physical, chemical and biological hazards at work. For example workers are simultaneously exposed to heat stress, noise, carbon monoxide, respiratory irritants, etc.
Established on the basis that they protect nearly all workers, **susceptible groups** or those with **preexisting medical conditions** may not be protected by exposure limit.
Factors such as *age, sex, reproductive status (pregnancy), genetic factors, drug therapy and lifestyle factors* such as smoking and alcohol use, may also play a role in the biological outcome of exposure to chemicals.
Patterns of exposure (combined exposures) and the impact of extended work hours, can also affect the biological outcome.
Although it is not possible to adjust the TLV for each of these parameters, they should be considered in the overall strategy to protect workers.
HEAT STRESS

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NOISE LEVEL MEASURING EQUIPMENT

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SOUND LEVEL MEASUREMENT

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PERSONAL NOISE DOSE MONITORING

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LUX METER

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DIRECT READING INSTRUMENTS
DIRECT READING INSTRUMENTS

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DIRECT READING INSTRUMENTS

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IR SPECTROPHOTOMETER

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IR SPECTROPHOTOMETER

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OCCUPATIONAL HYGIENE EQUIPMENT

A set of field and laboratory analytical equipment are required for practice of occupational hygiene.

A considerable diversity of instrumentation is available for industrial hygiene practice.

contd..
OCCUPATIONAL HYGIENE EQUIPMENT

Care must be taken that the correct choice of the equipment is made. All the instruments should be periodically calibrated and checked by qualified personnel.

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BIOLOGICAL MONITORING

Includes

- The assessment of worker exposure by measurement of some “index” chemical in a body fluid as evidence of exposure.

contd..
Biological Monitoring

- Assessment of worker health effects by measurement of some alterations in “normal” worker physiology.

Contd..
BIOLOGICAL SAMPLES

- Urine
- Blood
- Air
- Fat
- Milk
- Hair
- Nails, Etc.

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ANALYTICAL METHODS

- Chromatography
- HPLC
- AAS
- Ion selective electrodes
BIOLOGICAL MONITORING - BENZENE

The two urinary metabolites of benzene have been introduced as new biomarkers for determination of benzene exposure:

- trans,trans-muconic acid (tt-MA, 2,4-hexadienedioic acid) (500 µg ttMA/g creatinine, end-of-shift urine sample) and contd..

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BIOLOGICAL MONITORING - BENZENE

- S-phenylmercapturic acid (S-PMA, N-acetyl-S-phenyl-L-cysteine). (25 µg SPMA / g creatinine, end-of-shift urine sample)
Health Evaluation of Employees

Assessment and surveillance of employees’ health status by

- Pre employment/Pre placement examination: -
  to ensure that employees are placed on jobs suited to their capacities; contd..

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HEALTH EVALUATION OF EMPLOYEES

• Periodic health examination—annual/biennial— to monitor employees’ health in relation to specific health hazards, to determine the risk of development of subsequent disease or to identify the disease in its early symptomless state; contd..
HEALTH EVALUATION OF EMPLOYEES

• ‘Well-person’ screening for early evidence of chronic multifactorial illnesses as varied as heart diseases, hypertension, diabetes mellitus, etc. contd..
HEALTH EVALUATION OF EMPLOYEES

• Investigations, diagnosis and treatment of occupational / work-related illnesses;

contd..
HEALTH EVALUATION OF EMPLOYEES

Specific examinations-
- Pulmonary function tests,
- Hearing conservation program-audiometry,
- Toxicological / biological monitoring,
- Visual screening etc;

contd..
HEALTH EVALUATION OF EMPLOYEES

Specific examinations-

- Assessment of fitness to return to work after an illness or injury

contd..
CURATIVE ACTIVITIES

Provide or arrange the delivery of appropriate diagnostic, therapeutic and rehabilitative services for injuries and illnesses: for emergencies incidental to work such as cardiovascular, bronchial asthma etc. And contd..

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CURATIVE ACTIVITIES

For emergencies directly related to work - such as accidents involving machinery, falls etc. or over exposure to physical / chemical hazards.  contd..
CURATIVE ACTIVITIES

Case manage people who are on sick leave, working with the hospital to ensure the earliest return of functional capacity and return to work. contd..
PLANNING OF EMERGENCIES

The planning of emergencies in the event of catastrophies requires special attention. The OHS has the most important role of anticipating emergencies, of preparing policies for how to deal with them at the local level and of having an input into disaster planning. contd..
HEALTH PROMOTION

• Education for Health.
• Mental Health & counselling at individual level.
• Life style modification - Alcohol/smoking control programs, etc.  
  contd..
IMMUNIZATION

• Specific protection of employees by vaccinations.

contd..

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EDUCATION & TRAINING

• Initial and regular subsequent training of first-aid personnel, and supervision and maintenance of first-aid equipment.  contd..
EDUCATION & TRAINING

• Education of the personnel of the undertaking concerning employees’ work, its potential hazards and the employees’ responsibilities for safe and healthful work practices.  contd..
HEALTH INFORMATION SYSTEM

• Work environmental monitoring data,
• medical information,
• hazard information on each chemical exposure profile, and
• locations where potential exposures can occur.

contd..
HEALTH INFORMATION SYSTEM

• Make and retain appropriate records on occupational accidents, injuries and illnesses and to evaluate the overall health and safety status of the enterprise on the basis of such data. contd..
HEALTH INFORMATION SYSTEM

• Develop and maintain an efficient health data system of all employees – a computerized database and case management system.
THE SUMMARY

In the past the primary aim was the control of occupational diseases and the work environment.
The scope is much wider...

contd..
THE SUMMARY

Increasingly Occupational Health Services are being recognized as the provision of comprehensive health care to working populations.

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THE SUMMARY

The employee in the workplace is a natural target for preventive activities and since people spend about a third of their waking hours at work, the workplace is considered to have great potential for health promotion.
One of the attractions of occupational medicine is that it allows the doctor to combine the roles of looking after people in groups, practicing preventive medicine and

contd.
And administering a service with the more traditional diagnostic and therapeutic roles in relation to the individual. It is however vital that a correct balance is achieved.