Study on Occupational Health and Diseases in Oil Industry

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Abstract - *Occupational Health Hazard which is different from Occupational Safety Hazard is prevalently on the rise as industrialization increases in the global world. And identifying them in order to prevent and control them is very imperative to the health and well-being of the workers. The health and well-being of the workforce of a Company which is their most valuable asset should not be toyed with by the Management. Health Hazards which could result in the development of diseases and sicknesses is categorized into Physical Health Hazard, Chemical Health Hazard, Biological Health Hazard, Mechanical/Ergonomic Health Hazard and Psychosocial Health Hazard. These Health Hazards, usually, could be associated with most industrialized Organization and the Oil and Gas Refinery is not left out. This study will help to create awareness of the Occupational Health Hazards prevalent among Refinery workers and improve the Occupational Health and Safety of the Organization. Occupational safety and health is good for business as well as being a legal and social obligation.*

Key Words: Health, Safety, Hazards, Diseases, Fire.

1. INTRODUCTION

The petroleum industry began with the successful drilling of the first commercial oil well in 1859, and the opening of the first refinery two years later to process the crude into kerosene. The evolution of petroleum refining from simple distillation to today's sophisticated processes has created a need for health and safety management procedures and safe work practices. To those unfamiliar with the industry, petroleum refineries may appear to be complex and confusing places. Refining is the processing of one complex mixture of hydrocarbons into a number of other complex mixtures of hydrocarbons. The safe and orderly processing of crude oil into flammable gases and liquids at high temperatures and pressures using vessels, equipment, and piping subjected to stress and corrosion requires considerable knowledge, control, and expertise. Safety and health professionals, working with process, chemical, instrumentation, and metallurgical engineers, assure that potential physical, mechanical, chemical, and health hazards are recognized and provisions are made for safe operating practices and appropriate protective measures. These measures may include hard hats, safety glasses and goggles, safety shoes, hearing protection, respiratory protection, and protective clothing such as fire-resistant clothing where required. In addition, procedures should be established to assure compliance with applicable regulations and standards such as hazard communications, confined space entry, and process safety management.

2. PETROLEUM REFINERY PROCESS:

Petroleum refining has evolved continuously in response to changing consumer demand for better and different products. The original requirement was to produce kerosene as a cheaper and better source of light than whale oil. The development of the internal combustion engine led to the production of gasoline and diesel fuels. The evolution of the airplane created a need first for high-octane aviation gasoline and then for jet fuel, a sophisticated form of the original product, kerosene. Present-day refineries produce a variety of products including many required as feedstock for the petrochemical industry.

2.1 Distillation Processes

The first refinery, opened in 1861, produced kerosene by simple atmospheric distillation. Its by-products included tar and naphtha. It was soon discovered that high-quality lubricating oils could be produced by distilling petroleum under vacuum. However, for the next 30 years kerosene was the product consumers wanted. Two significant events changed this situation: (1) invention of the electric light decreased the demand for kerosene, and (2) invention of the internal combustion engine created a demand for diesel fuel and gasoline (naphtha).

2.2 Thermal Cracking Processes

With the advent of mass production and World War I, the number of gasoline-powered vehicles increased dramatically and the demand for gasoline grew accordingly. However, distillation processes produced only a certain amount of gasoline from crude oil. In 1913, the thermal cracking process was developed, which subjected heavy fuels to both pressure and intense heat, physically breaking the large molecules into smaller ones to produce additional gasoline and distillate fuels. Visbreaking, another form of thermal cracking, was developed in the late 1930's to produce more desirable and valuable products.

2.3 Catalytic Processes

Higher-compression gasoline engines required higher-octane gasoline with better antiknock characteristics. The introduction of catalytic cracking and polymerization processes in the mid-to late 1930's met the demand by providing improved gasoline yields and higher octane numbers. Alkylation, another catalytic process developed in the early 1940's, produced more high-octane aviation gasoline and petrochemical feedstock for explosives and synthetic rubber. Subsequently, catalytic isomerization was

developed to convert hydrocarbons to produce increased quantities of alkylation feedstock. Improved catalysts and process methods such as hydrocracking and reforming were developed throughout the 1960's to increase gasoline yields and improve antiknock characteristics. These catalytic processes also produced hydrocarbon molecules with a double bond (alkenes) and formed the basis of the modern petrochemical industry.

2.4 Treatment Processes

Throughout the history of refining, various treatment methods have been used to remove non hydrocarbons, impurities, and other constituents that adversely affect the properties of finished products or reduce the efficiency of the conversion processes. Treating can involve chemical reaction and/or physical separation. Typical examples of treating are chemical sweetening, acid treating, clay contacting, caustic washing, hydro treating, drying, solvent extraction, and solvent dew axing. Sweetening compounds and acids desulfurize crude oil before processing and treat products during and after processing. Following the Second World War, various reforming processes improved gasoline quality and yield and produced higher-quality products. Some of these involved the use of catalysts and/or hydrogen to change molecules and remove sulfur. A number of the more commonly used treating and reforming processes are described in this chapter of the manuals.

3. OCCUPATIONAL HEALTH HAZARDS

Workplace health hazards generally differ from those found in the general environment. Furthermore, because workers are often exposed in confined spaces, exposure levels to workplace hazards are often much higher than exposures to hazards in the general environment. In developing countries, workers may be exposed simultaneously to workplace hazards, to an unsafe housing environment, and a polluted general environment.

Occupational Health Hazards are broadly divided into Physical, Chemical, Biological, Behavioral, Psychosocial, and Mechanical/Ergonomics.

Physical Hazards: Physical hazards are often said to be less important than chemical hazards but this is not so. They can and do cause several health problems, injuries or even death. The nature of physical agents is wide and should not be underrated but the main ones capable of causing occupational disorders and injuries are:

1. Noise

2. Illumination

3. Vibration

4. Radiation (ionizing and non-ionizing)

5. Microclimatic conditions in the case of extreme heat and cold.

3.1 Mechanical and Ergonomics Hazards

Unshielded machinery, unsafe structures in the workplace and dangerous tools are some of the most prevalent workplace hazards in developed and developing countries. In Europe, about 10 million occupational accidents happen every year (some of them commuting accidents). Adoption of safer working practices, improvement of safety systems and changes in behavioral and management practices could reduce accident rates, even in high-risk industries, by 50% or more within a relatively short time. Approximately 30% of the workforce in developed countries and between 50% and 70% in developing countries may be exposed to a heavy physical workload or ergonomically poor working conditions, involving much lifting and moving of heavy items, or repetitive manual tasks. Workers most heavily exposed to heavy physical workloads include miners, farmers, lumberjacks, fishermen, construction workers, storage workers and healthcare personnel. Repetitive tasks and static muscular load are also common among many industrial and service occupations and can lead to injuries and musculoskeletal disorders. In many developed countries such disorders are the main cause of both short-term and permanent work disability and lead to economic losses amounting to as much as 5% of GNP.

3.2 Biological Hazards

Exposure to some 200 biological agents, viruses, bacteria, parasites, fungi, moulds and organic dusts occurs in selected occupational environments. The hepatitis B and hepatitis C viruses and tuberculosis infections (particularly among healthcare workers), asthma (among persons exposed to organic dust) and chronic parasitic diseases (particularly among agricultural and forestry workers) are the most common occupational diseases resulting from such exposures. Blood-borne diseases such as HIV/AIDS and hepatitis B are now major occupational hazards for healthcare workers. This can be classified into: 1. Human tissue and body fluids

2. Microbial pathogens (in laboratory settings)

3. Genetically modified organisms

4. Animals and animal products

5. Organic dusts and mists

3.3 Chemical Hazards

About 100 000 different chemical products are in use in modern work environments and the number is growing. High exposures to chemical hazards are most prevalent in industries that process chemicals and metals, in the manufacture of certain consumer goods, in the production of textiles and artificial fibres, and in the construction industry. Chemical hazards could be classified into:

1. Particles, fibers, fumes and mist: Carbon Black, Welding Fume, Oil Mist

2. Metals and metalloids : Arsenic, Cadmium, Chromium, Mercury, Zinc

3. Organic, solvents and compounds: Acetone, hydrocarbons, Benzene

4. Inorganic gases: Carbon monoxide, Hydrogen sulphide, Sulphur dioxide Chemicals are also increasingly used in virtually all types of work, including non-industrial activities such as hospital and office work, cleaning, and provision of cosmetic and beauty services.

Exposure varies widely. Health effects include metal poisoning, damage to the central nervous system and liver (caused by exposure to solvents), pesticide poisoning, dermal and respiratory allergies, dermatoses, cancers and reproductive disorders. In some developing countries, more than half of the workers exposed to dust-containing silica in certain high-risk industries (such as mining and metallurgy) are reported to show clinical signs of silicosis or other types of pneumoconiosis. About 300–350 substances have been identified as occupational carcinogens. They include chemical substances such as benzene, chromium, nitrosamines and asbestos, physical hazards such as ultraviolet radiation (UVR) and ionizing radiation, and biological hazards such as viruses. In the European Union alone, approximately 16 million people are exposed to carcinogenic agents at work. The most common cancers resulting from these exposures are cancers of the lung, bladder, skin, mesothelium, liver, haematopoietic tissue, bone and soft connective tissue. Among certain occupational groups, such as asbestos sprayers, occupational cancer may be the leading factor in ill-health and mortality. Due to the random character of effect, the only effective control strategy is primary prevention that eliminates exposure completely, or that effectively isolates the worker from carcinogenic exposure.

3.4 Psychosocial Hazards

Psychosocial hazards comprises of the psychological and social hazards. Psychological hazards are caused when time and a work pressure has become more prevalent during the past decade. Monotonous work, work that requires constant concentration, irregular working hours, shift-work, and work carried out at risk of violence (for example, police or prison work), isolated work or excessive responsibility for human or economic concerns, can also have adverse psychological effects. Psychological stress and overload have been associated with sleep disturbances, burn-out syndromes and depression.

Epidemiological evidence exists of an elevated risk of cardiovascular disorders, particularly coronary heart disease and hypertension in association with work stress. Severe psychological conditions (psychotraumas) have been observed among workers involved in serious catastrophes or major accidents during which human lives have been threatened or lost. Social conditions of work such as gender distribution and segregation of jobs and equality (or lack of) in the workplace, and relationships between managers and employees, raise concerns about stress in the workplace. Many service and public employees experience social pressure from customers, clients or the public, which can increase the psychological workload. Measures for improving the social aspects of work mainly involve promotion of open and positive contacts in the workplace, support of the individual's role and identity at work, and encouragement of teamwork.

Organizational Psychosocial factors include but not limited to the following:

1. Violence and aggression
2. Lone working
3. Shift and night work
4. Long working hours
5. Time zone changes

Exposure to the estimated 3000 allergenic agents in the environment is mainly occupational. In the work environment, such hazardous agents enter the body via the respiratory tract or the skin. Allergic skin diseases are some of the most prevalent occupational diseases. Occupational respiratory diseases should therefore be the focus of any occupational health programme. Occupational asthma, for instance, is caused by exposure to various organic dusts, microorganisms, bacteria, fungi and moulds, and several chemicals. The increased number of people who develop an allergic response, coupled with high numbers of occupational allergenic exposures and improved diagnostic methods, has led to a steady growth in the registered numbers of occupational asthma cases in several industrialized countries (WHO, June 2013). The great variety of occupational health hazards makes quantification of their associated health risks and impacts at the global level very difficult. Some estimates have been based on the occupational injuries and diseases reported in official statistics. But a large number of injuries and diseases caused by workplace hazards are not reported. Adjustment is therefore necessary. Making such adjustment, ILO and WHO estimate that there may be as many as 250 million occupational injuries each year, resulting in 330 000 fatalities.

4. OCCUPATIONAL HEALTH DISEASE

Occupational health disease can be defined as a compensable disease contacted by the worker due to exposure to hazards in the work places.

4.1 Classification of Occupational Diseases

Occupational diseases can be classified in different forms.

1. Occupational diseases of the respiratory system
2. Occupational diseases of the liver

3. Occupational diseases of the cardiovascular system

4. Occupational diseases of the Gastro-intestinal system

5. Occupational diseases of the Genito-urinary system

6. Occupational diseases of the skin or dermatologic system

7. Occupational diseases of the musculoskeletal system

8. Occupational diseases of the haemopioetic system

9. Occupational diseases of the physical agent.

The occupation or the nature of work performed by a person exposes him or her to health hazards associated with that occupation. Diverse occupations exist. They include traditional manufacturing industries (automobile. automotive and appliances); service industries (banking, health care, and restaurant); education, agriculture, construction, mining, and newly high technology firms like computer chips manufacturing companies and many others.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

Table -1 - Average of Ambient Air Mass

S. No	(Area)	O^2 %	LEL Methane (%)	CO (ppm)	NH3 (ppm)	H2S (ppm)

Table 2 - Average of Noise Level

S/N	Location	Noise Level (Dba)	Max Allowable Limit

5. RECOMMENDATIONS

Three main strategies are used to achieve OHS which are Health Promotion, Protection and Rehabilitation in the workplace.

5.1 Health Promotion includes

a. Health Risk Assessment which is a management tool that allows the workplace comply with her occupational policy, helps the workers do their jobs without damage to their health, enables the workplace meet her legal responsibilities, enables the workplace show due diligence in the protection and promotion of the health of the workers, provides an auditable platform and involves the work force in protecting the health of the workers.

b. Biological Monitoring/Medical Surveillance that involves periodic medical examination including pre employment medical examination, health assessment and biological test. Sickness absence monitoring, reporting of occupational diseases and illnesses and ethical and legal issues.

c. Training

d. Physical Activities

e. Strict enforcement and implementation of the Organizational Occupational Health and Safety Policies with strategic planning should be put in place to imbibe Behavioral Occupational Health and Safety culture in the staff of the Refinery.

f. Management Commitment and Resources though advocacy

5.2 Health Protection

a. Elimination: using a hazardous material from use in the workplace so that no further exposure is possible.

b. Substitution: replacing a very hazardous material with a less hazardous one.

c. Modification: changing a process or procedure to eliminate or reduce emissions.

d. Containment: using physical barrier or containment to separate materials or environment from work areas. e. Ventilation: removing or diluting hazardous materials in the air by removing the contaminated air and replacing it with outside air.

f. Workplace Practice: Work practices are procedures that limit worker exposure by reducing exposure times or keeping workers away from contaminants. The following are some common work practices; Scheduling, Good Housekeeping and Personal Hygiene Practices, Policies and Procedures

g. Personal Protective Equipment (PPE): Equipment such as gloves and goggles are used to protect workers from hazards. PPE is less effective because the hazard is still present and workers are not protected if the PPE fails. PPE should only be used if necessary after other control measures are implemented or if other controls are not practicable.

5.3 Health Rehabilitation

a. Immediate Support and Initial Administrative Processes

b. Duty of Care - Safe Return Home After Injury

c. Book Keeping and Reporting Injuries/Illnesses

d. Effective Early Communication

6. CONCLUSIONS

The Occupational Health Hazards that could affect the health and well-being of Refinery workers are:

1. Physical Health Hazard – Noise.

2. Chemical Health Hazards – O2, CO, NH3, C2H4 and H2S.

3. Mechanical/Ergonomic Health Hazards – obsolete machines and equipment's.

4. Biological Health Hazard – Organic dust (carbon black).

Identification of Occupational Health Hazards, the awareness of the workers on the health hazards, the risk associated with them and the effectiveness of the Occupational Health Practices is crucial in the promotion, protection and rehabilitation of the health and well-being of people working in the Refinery.

Occupational Health and Safety should be an integral part of production processes of an organization should not be toyed with by the Staff and Management of the any industrial and production organization and the Oil and Gas Refinery should not be seen lacking in this area. It is to this regard that it is imperative with a form of urgency that the following recommended Management Protocol should be added to the already existing practices by Management and Staff of the Refinery However, work related-illnesses and diseases could be caused by two major factors: workers‟ susceptibility and the workplace environment and conditions.

Table 3 - Factors of Work Related-Illness and Diseases

WORKERS SUSCEPTIBILITY FACTORS	WORKPLACE FACTORS
Genetic	Multiplicity of Exposure
lifestyle	Duration of Exposure
Age	Physical Properties
Race	Magnitude of Exposure
Gender	Timing of Exposure
Medical History	Threshold Limit

And it could usually take some time before the manifestation of the diseases on the worker could be diagnosed. Hitherto, Health Effect Management Process which is an element in Occupational Health and Safety amongst Leadership and Commitment, Policy and Strategic Objectives, Organization, Responsibilities, Resources, Standards and Documents, Planning and Procedures, Implementation and Monitoring, Audit and Review is recommended management protocol that would assist an Oil and Gas Refinery Management protects, promotes and rehabilitates the health and well-being of their workers.

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