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The petrochemicals sector is a major segment of manufacturing industry as it has several connections with other sectors of an economy. Petroleum distillates (petrochemicals) are any of a large group of chemicals derived from petroleum and natural gas either by direct manufacture or indirect manufacture as by-products which are used commercially. Oil and natural gas are supposed to be the main sources for most petrochemicals because they are economical and readily accessible. Manufacturing of petrochemical products requires about 5% of the oil and gas each year. Petrochemicals share nearly 40 per cent of world chemicals market. Petrochemicals play a major role in today's society as they are essential for food, clothing, shelter and leisure. The petrochemicals are used in many industries like polymers, synthetic fibers, synthetic rubber, plastics, soaps and detergents, solvents, drugs, fertilizers, pesticides, explosives, paints, and flooring and insulating materials. Petrochemicals are found in distinct products as aspirin, polyester clothes, luggage, boats, automobiles, air craft and recording discs and tapes. Lubricating oil, kerosene, diesel fuel, gasoline, LPG and jet fuel are not included in petrochemicals as these are not chemical compounds but are mixtures of hydrocarbons.

The petrochemical industry is responsible for manufacturing many of the things we use every day. Petrochemicals are useful in food industries, pharmaceutical industries, agricultural industries and technology industries. These chemicals can be used in making fertilizers, polymers, solvents, dyes, pesticides, detergents, cosmetics, etc. These are exploited as fuel and

lubricants for automotive and industrial purposes. Petrochemical products such as petrol, diesel, and other lubricants are in great demand in the market due to tremendous increase in number of vehicles. Petrochemicals may be used as food grade lubricants in pharmaceutical; food processing plants is beverage industries. Petroleum jelly utilized as ointment base, lubricant and protective covering obtained from petroleum. Another important use of petrochemicals is as preservatives and food-additives which increase the tenure of freshness of canned food. Cosmetics that contain oils, perfumes are petroleum derivatives. The flexible rubber shoes which remain intact in all weathers are produced by using petrochemicals. Dyes having various colors are also one of the most important usages of petrochemical products. Petrochemical ethylene is used in photographic film, food packaging, construction components, garbage bags etc.

Hazards Associated with Petrochemical Industries

Although the petrochemicals give us innumerable useful products but they can also be injurious to the health of living beings and the earth's ecosystem. Most of these chemicals when released can exhibit unfavourable effects on our environment such as air, water and soil pollution. The aromatic compounds present in petrochemicals are important environmental pollutants which may be introduced into the environment through natural oil seeps, industry waste products and emissions, oil storage wastes, accidental spills from oil tankers, coal tar processing wastes, petrochemical industrial effluents and emissions etc. Petrochemical industry is an important source for the principal greenhouse gases responsible for global warming. Other environmental impacts include ozone layer depletion, acid rain, air pollution etc. In the petrochemical industry, potentially harmful substances release dare noxious, foul odour, or combustible.

In areas nearby petrochemical industries, elevated sound levels induce noise pollution associated with feelings of headache, annoyance, uneasiness, stress, impatience, displeasure, hypersensitivity, extreme anxiety, anger, endangerment and violence. Contamination of soils may take place from residuals of refining processes including some hazardous wastes, catalysts or coke dust, tank bottoms, and sludge from the treatment processes. The petrochemical industry may also come up with loss of biodiversity and destruction of ecosystems. Effluents coming out of petrochemical industries contain a large amount of polycyclic and aromatic hydrocarbons, phenols, metal derivatives, surface-active substances, sulphides, naphthylenic acids and other chemicals. Due to the inefficient purification systems, toxic products present

in effluents accumulate in the water bodies resulting in water pollution which is fatal to both aquatic and human life. Exposure to petrochemicals may take place in different ways; they may be absorbed through the skin or might be ingested. They can also affect human life by accumulating in tissues/organs and cause brain, nerve and liver damage, birth defects, cancer, asthma and hormonal disorders. Skin irritation, ulcers and allergic dermatitis are chronic effects of exposure.

Pollution Prevention and Control

Petroleum refineries are complex plants, and the combination and sequence of processes is usually very specific to the characteristics of the raw materials (crude oil) and the products. Specific pollution prevention or source reduction measures.

However, there are a number of broad areas where improvements are often possible, and site-specific waste reduction measures in these areas should be designed into the plant and targeted by management of operating plants. Areas where efforts should be concentrated are discussed here.

Reduction of Air Emissions

• Minimize losses from storage tanks and product transfer areas by methods such as vapor recovery systems and double seals.
• Minimize SOx emissions either through desulfurization of fuels, to the extent feasible, or by directing the use of high-sulfur fuels to units equipped with SOx emissions controls.
• Recover sulfur from tail gases in high-efficiency sulfur recovery units.
• Recover non-silica-based (i.e., metallic) catalysts and reduce particulate emissions.
• Use low-NOx burners to reduce nitrogen oxide emissions.
• Avoid and limit fugitive emissions by proper process design and maintenance.
• Keep fuel usage to a minimum. Elimination or Reduction of Pollutants
• Consider reformate and other octane boosters instead of tetraethyl lead and other organic lead compounds for octane boosting.
• Use non-chrome-based inhibitors in cooling water, where inhibitors are needed.
• Use long-life catalysts and regenerate to extend the catalysts' life cycle. Recycling and Reuse
• Recycle cooling water and, where cost-effective, treated wastewater.

Elimination or Reduction of Pollutants

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Recycling and Reuse

• Recycle cooling water and, where cost-effective, treated wastewater.

• Maximize recovery of oil from oily wastewaters and sludges. Minimize losses of oil to the effluent system.

• Recover and reuse phenols, caustics, and solvents from their spent solutions.

• Return oily sludges to coking units or crude distillation units.

Operating Procedures

• Segregate oily wastewaters from stormwater systems.

• Reduce oil losses during tank drainage carried out to remove water before product dispatch.

• Optimize frequency of tank and equipment cleaning to avoid accumulating residue at the bottom of the tanks.

• Prevent solids and oily wastes from entering the drainage system.

• Institute dry sweeping instead of washdown to reduce wastewater volumes.

• Establish and maintain an emergency preparedness and response plan and carry out frequent training.

• Practice corrosion monitoring, prevention, and control in underground piping and tank bottoms.

• Establish leak detection and repair programs.

Treatment Technologies

Air Emissions

Control of air emissions normally includes the capture and recycling or combustion of emissions from vents, product transfer points, storage tanks, and other handling equipment. Boilers, heaters, other combustion devices, cokers, and catalytic units may require particulate matter controls. Use of a carbon monoxide boiler is normally a standard practice in the fluidized catalytic cracking units. Catalytic cracking units should be provided with particular removal devices. Steam injection in flaring stacks can reduce particulate matter emissions.

Liquid Effluents

Refinery wastewaters often require a combination of treatment methods to remove oil and contaminants before discharge. Separation of different streams, such as stormwater, cooling water, process water, sanitary, sewage, etc., is essential for minimizing treatment requirements. A typical system may include sour water stripper, gravity separation of oil and

water, dissolved air flotation, biological treatment, and clarification. A final polishing step using filtration, activated carbon, or chemical treatment may also be required.

Solid and Hazardous Wastes

Sludge treatment is usually performed using land application (bioremediation) or solvent extraction followed by combustion of the residue or by use for asphalt, where feasible. In some cases, the residue may require stabilization prior to disposal to reduce the leachability of toxic metals. Oil is recovered from slops using separation techniques such as gravity separators and centrifuges.

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2. NPTEL- Chemical technology