PRELIMINARY FEASIBILITY REPORT (PFR)

POLYOL/PROPYLENE GLYCOL/MONO ETHYLENE GLYCOL PETROCHEMICAL PROJECT
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1. EXECUTIVE SUMMARY

1.1 Background

As part of the petrochemicals foray of BPCL group, it is envisaged to increase the percentage of the petrochemicals portfolio on crude oil throughput by implementation of various projects for production of Petrochemicals in our refineries. This includes the Propylene based Petrochemical initiatives at Kochi Refinery.

Post commissioning of the Integrated Refinery Expansion Project (IREP), 500 kTPA (Thousand Metric Tonnes per Annum) of Polymer grade Propylene is available from Petro Fluid Catalytic Cracking Unit (PFCCU) at Kochi, for utilization as Petrochemical feedstock. There also exists potential for recovery of Ethylene, a valuable Petrochemical feedstock, from refinery off-gases.

Propylene Derivatives Petrochemical Project (PDPP), which is under implementation, will utilize 250 kTPA of aforesaid Propylene for manufacture of Niche/specialty petrochemicals viz. Acrylic Acid, Oxo Alcohol and Acrylates, with applications in areas like paints & coatings, adhesives, solvents etc.

The other potential Propylene based niche specialty Petrochemical portfolio with high growth rate/demand has been identified as Polyols and Propylene Glycol (PG). The balance 250 kTPA of available Propylene is proposed to be utilized for manufacture of these products which find major applications in sectors like automotive, refrigeration, construction, footwear, coatings, adhesives, sealants etc.

There exists a potential for further value addition by recovering Ethylene available from refinery off-gases. This Ethylene is proposed to be utilized for production of Ethylene oxide (EO), which is required for major grades of Polyols. Balance available quantity of EO is proposed to be utilized to produce Mono Ethylene Glycol (MEG), another value added Petrochemical.

Fluor Daniel India Pvt Ltd (Fluor) was engaged as consultant to conduct a study and establish the feasibility of the proposed petrochemical project. Detailed Market Survey was carried out by International Consultant, IHS Chemical (IHS). The economics appear to be favorable and hence it is proposed to proceed with the project.
1.2 Need for a facility to produce Niche Petrochemicals

Petrochemicals market in India is fast growing & profitable with open market pricing with a hedge for refining. Combined Refinery-Petrochemical complexes can be best option for global competitive advantage, due to availability of low cost feed stock from the refinery.

Currently there is limited production of Polyols/Propylene Glycol (PG) in India due to limited availability of an important intermediate Propylene Oxide (PO), which requires Propylene feedstock. PO is the intermediate which is mainly used for production of Polyols (73%) and Propylene Glycol (14%). Propylene Oxide (PO) is manufactured by reacting Propylene with an Oxygen carrying intermediate, in the presence of catalyst.

The niche Propylene derivatives Petrochemical project offers an attractive opportunity for BPCL for utilizing the balance polymer grade Propylene feed stock from BPCL-KR IREP facility to meet this demand for niche petrochemicals. The proposed project will be a self contained facility and will be set up contiguous to the Kochi Refinery of Bharat Petroleum Corporation Limited, in order to achieve synergies of integration with feedstock source, a vital element in the success of a project.

1.3 Applications of Polyols/Propylene Glycol (PG)/ Mono Ethylene Glycol (MEG)

Polyols are mainly used in flexible foam applications (furniture & bedding). An important end product of Polyol is Polyurethane foam, the usage of which is growing rapidly in the Indian market. Rest of the application is in Rigid foam (automobiles), moulded foam and non-foam application. Growth in Automobiles demand, footwear usage and a growing middle class are expected to drive the usage of Polyols.

PG is used in Pharmaceuticals, unsaturated Polyester resin, food flavors and fragrances. Majority of the Unsaturated Polyester resin is used in the Fibre Reinforced Plastic market (FRP).

MEG is consumed primarily in the production of Polyester and Polyethylene Terephthalate (PET), which is subsequently used for the production of fibers, films, solid-state resins, and other consumables. Polyester/PET applications and Antifreeze formulations also find use of MEG. Overall, consumption of Ethylene Glycols is broadly tied to the general economy, where the improvement in living standards is driving an increasing use of packaging, films, and textile fibers.
1.4 Technology

The technology for Propylene based niche petrochemicals is mainly proprietary. There are very few technology licensors available worldwide, who have developed a commercially proven technology. There are many technology routes available for the production of important intermediate Propylene oxide (PO). This project intends to source technologies that are economical and environmental friendly.

1.5 Configuration

The envisaged Plant configuration comprises of one unit each that shall produce intermediates such as Propylene Oxide (PO), Ethylene Recovery Unit, Ethylene Oxide (EO), and associated units, as the case may be. Further downstream units shall consist of one unit each that produces final products Polyols, Propylene Glycol (PG) and Mono Ethylene Glycol (MEG).

1.6 Environmental Aspects

The generation of potential wastes from the various units and their disposal/management will be given due consideration while designing the plant to have minimum environment impact with adherence to the local environmental norms. The facility would produce liquid, gaseous and solid wastes from the process units. Most of the solid waste generated consists of spent catalyst can be used for land filling or precious metal recovery, if feasible. Waste water will be treated within the complex so as to meet statutory norms. Design of the units will ensure that the gaseous emissions meet the statutory norms.

1.7 Basic Infrastructure Requirements

a. Land

The Propylene based Petrochemical project needs to be located in the proximity of Kochi Refinery to facilitate easy transportation of Propylene, utilities & other raw materials. It is estimated that about 200 acres of land would be required for the project, including the mandatory requirement of green belt area. Facilities will be located within the existing refinery and 170 acres being purchased from FACT. The land acquired is in the vicinity of Kochi Refinery. The site acquired near the refinery is suitable for feedstock and other Utilities & raw material transfer through pipelines.

b. Water

A preliminary estimate of the water requirement for the project is 1260 m$^3$/hr. A proposal to source water from new source has been submitted to Govt of Kerala.
c. Power consumption

Estimated 104 MW power is required for the Petrochemical complex. The requirement will be met from the State grid and internal generation.

1.8 Project Economics

The operating cost, sales revenue and financial analysis have been carried out for calculating internal rate of return (IRR) with a view to establish profitability of the project. Project economics appears to be favorable with a 16.4% IRR (post tax).

1.9 Capital Cost

The estimated capital cost for the Propylene based niche derivative Petrochemical project is approximately Rs 8967 crore based on a feed capacity of 250 TMT polymer grade Propylene.

1.10 Period of Implementation

The Project is expected to be completed within 44 months from the date of environmental clearance.

1.11 General Advantage for the Project

Petrochemical industry is important to the development of economy since it is the basis for the string of downstream and related industries which are needed for fundamental products namely housing, food, clothing, and medicine. Petrochemicals play a vital role in the functioning of virtually all key sectors of economy which include agriculture, infrastructure, healthcare, pharmaceuticals, textiles, and consumer durables.

The proposed petrochemical project is being conceived as a “Make in India” project, which will uplift the socio-economic environment and bring tremendous growth opportunity to the region. Kochi region in Kerala is an ideal location for the emergence of a major petrochemical manufacturing hub in the India, offering benefits such as:

a) Polyols and Propylene glycols are predominantly imported. Local manufacturing of these petrochemicals shall reduce import and thus, save foreign exchange. Petrochemical Park planned by Kerala state government will be directly benefitted by providing a local source of feedstock to various downstream industries.

b) Opportunity to strengthen the Indian economy by providing direct and indirect employment during construction and operation phases, which will benefit the local economy.
2. Objectives

2.1 Background

BPCL-KR has recently commissioned the Integrated Refinery Expansion Project (IREP) to expand the crude processing capacity to 15.5 MMTPA, produce polymer grade Propylene (500 kTPA) and fuels conforming to EURO-IV norms.

In the Refining business the availability of petrochemicals in the product portfolio, hedges against drop in price/demand of fuels. Besides, integration of Refining and Petrochemicals can lead to better profit margins. Propylene Derivatives Petrochemical Project (PDPP), which is under implementation, will utilize 250 kTPA of aforesaid Propylene for manufacture of Niche/specialty petrochemicals viz. Acrylic Acid, Oxo Alcohol and Acrylates, with applications in areas like paints & coatings, adhesives, solvents etc. It is proposed to produce value added Petrochemicals at Kochi, from the balance 250 kTPA of Propylene and available Ethylene feedstock. Hence BPCL proposes to set up another world scale petrochemical plant adjacent to the refinery complex in Kochi, Kerala to produce Propylene based niche specialty chemicals, which are predominantly imported into the country. With a growing economy niche product demand are expected to further increase in the near future.

The Project is proposed to be set up as part of the existing refinery with integration of facilities wherever possible. Technology is being sourced from reputed licensors who have the capability to provide the latest commercially developed proprietary technology and also undertake the design of the plant including operation support and marketing.

Feedstock & Product Slate

- Feedstock: 250 kTPA of polymer grade Propylene from IREP project
- Proposed Product slate is as follows

<table>
<thead>
<tr>
<th>Product</th>
<th>Production (kTPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyols</td>
<td>250</td>
</tr>
<tr>
<td>Propylene Glycol</td>
<td>100</td>
</tr>
<tr>
<td>Mono Ethylene Glycol</td>
<td>110</td>
</tr>
</tbody>
</table>

The Products are proposed to be sold in the domestic market. Hence this is an Import substitution “Make in India” project.

The project shall also source its part requirement of Utilities from the existing refinery. Some
of the facilities are proposed to be set within the existing refinery. Hence considerable synergy exists between the proposed petrochemical project and the refinery. Niche Propylene derivatives are mostly imported into India. The market for niche Propylene derivatives is fast growing and profitable and BPCL as a refiner has feedstock advantage. The petrochemical project being set up at Kochi, Kerala shall be the second niche chemical manufacturing facility that targets import substitution reducing dependence on imports and shall result in foreign exchange savings. The configuration selected for the integrated facility is unique and no such plant currently exists in India. The technology employed shall be state of the art proprietary technology. Licensors shall provide periodic Research and development updates.

2.2 Project Configuration

The configuration of the Petrochemical complex as indicated below

- Production of intermediate Propylene Oxide (PO) from polymer grade Propylene feedstock supplied by IREP
- Recovery of Ethylene from Refinery Off-gas
- Production of Ethylene Oxide (EO)/Mono Ethylene Glycol (MEG)
- Manufacture of different grades of Polyols
- Manufacture of Propylene Glycol
- Associated facilities for production of feedstock required for above units

2.3 Key Considerations for the Project

- 250 kTPA of Propylene availability from IREP project
- Facilities will be set up for production of intermediate feedstocks / products such as PO and EO and will be consumed internally to produce Polyols, PG and MEG
- Storage of intermediate and final products will be considered according to production plan
- The facilities are proposed to be implemented in the land procured from neighboring Fertilizers and Chemicals Travancore Ltd (FACT).
- Power will be sourced from the grid and through internal generation
- All required Utility facility such as Steam, plant air, nitrogen, instrument air, refrigeration, cooling tower etc. will be set up within the complex. Feasibility of integration with the existing refinery will be explored during further detailing.
- All effluents in the complex will be treated and disposed as per statutory norms.
- It is proposed to locate certain facilities within the refinery complex
2.4 Unit Capacity & On stream factor

The capacities of the proposed units are based on the demand-supply balance and economical size of process units. The proposed configuration will use 250,000 Metric Tons Per Annum Polymer grade Propylene as feedstock from BPCL-KR.

The stream hours considered for the project is 8000 hours/annum.

2.5 Material Balance / Feed & Product

The main feedstock for the units is Polymer Grade Propylene/ Ethylene and other raw materials such as Hydrogen Gas, CO/CO2, R-LNG, Oxygen, Benzene etc. will depend on the technology route selected. Other raw materials will be procured from the market, both locally and from sources outside the state.

A schematic process flow diagram is given below

Process Description

Propylene Oxide

Intermediate Propylene Oxide (PO) will be produced using one of the several technology routes available. Third generation technologies utilize an epoxidation catalyst for direct oxidation of Propylene feedstock to produce PO.
**Ethylene Recovery Unit**

Refinery off-gas after amine treatment is routed to the caustic wash scrubber to remove H2S and CO2 impurities and sent to the light end gas compressor. The compressed Off-gas is sent to downstream units consisting of Demethanizer, Acetylene polishing unit, Poison removal beds, dryers, De-ethanizer and a cold box to produce pure Ethylene. Rest of the off-gas is sent back to the refinery header or consumed within the complex.

**Mono Ethylene Glycol**

Intermediate Ethylene oxide (EO) is produced by oxidizing Ethylene with Oxygen in the presence of catalyst. Some amount of EO is routed to storage for downstream production of certain grades of Polyols. A major part of the EO is reacted with water to produce Mono Ethylene Glycol (MEG).

**Polyols**

The Polyols unit will be designed to produce various grades of Polyols such as Flex Polyols, Rigid Polyols and Case Polyols to meet market demands of Polyols. The polyol process consists of pre-treatment section, reaction section, post treatment section and vent scrubbing.

The Pre-Treatment Section feeds starting material (Initiators) including dosing and melting or dissolving of solid starters where required. It also pre-heats, adds catalyst, and dehydrates the catalysed raw material. After the pre-reaction operations are completed, the Alkylene oxide (Propylene oxide and/or Ethylene oxide) feed can be started in the reactor. The reactor always operates under sufficient partial pressure of Nitrogen to avoid the possibility of decomposition of Alkylene oxide. When the required quantity of Alkylene oxide has been fed and the feed stopped, the reaction is continued until all the Alkylene oxide is essentially exhausted. The crude product from reactor is then transferred to the Post Treatment Section.

The Post Treatment Section comprises the neutralization, filtration and solvent washing. The crude product is neutralized with mineral acid or solid adsorbent and then filtered to remove the precipitated salt. The filtered product is recycled to the neutralizer until the product appears clear. Then the filtered product is discharged to the intermediate storage for antioxidant addition and final product quality control.

**Propylene Glycol (PG)**

Propylene oxide is reacted with water to produce Propylene Glycol. By-products such as Di propylene Glycol (DPG) and Tri-propylene Glycol (TPG) are also produced.
2.6 Product Details/Applications

(a) Polyols

Polyether Polyols are used in the production of polyurethane polyols, which are used to make polyurethane foams, coatings and adhesives. Polyols and isocyanates are basic building blocks in the production of a wide range of both flexible and rigid polyurethane foams. Almost all automotive seating is cushioned with polyurethane foam. Polyols are used including carpet cushioning, in underlays, variety of rigid foams are used for building insulation and in both commercial and residential refrigeration. Polyols are also used in the production of non-foam urethanes for applications such as sealants and adhesives, elastomers and various industrial and consumer coatings(CASE application). Polyols are produced by the polyaddition of Propylene oxide and / or Ethylene oxide to chain starters such as Dipropylene glycol, glycerine, amine, sorbitol, sugar and similar compounds containing an active hydrogen.

(b) Propylene Glycol (PG)

Propylene Glycol is produced by the addition of Propylene Oxide to water. Propylene Glycol (PG) is widely used in the manufacture of Unsaturated Polyester Resins, in fibreglass-reinforced plastics, humectants for food products, in cosmetics, low toxicity antifreeze coolants, heat transfer solutions, and lubricants, surfactants in dyes and in paints & coatings and de-icing fluids. PG also finds application in hydraulic fluids, plasticizers, packaging materials and as a chemical intermediate and in pharmaceutical industry.

(c) Mono Ethylene Glycol (MEG)

Within the ethylene glycols product group, MEG is by far the largest-volume product, accounting for more than 90% of the overall ethylene glycols market. MEG is consumed primarily in the production of polyester (polyethylene terephthalate or PET), which is subsequently used for the production of fibres, films, solid-state resins, and other consumables. Polyester/PET applications are estimated to take around 94% of Indian MEG consumption in 2017. Antifreeze formulations are estimated to take around 4% of the Indian MEG share in 2017. Overall, consumption of ethylene glycols is broadly tied to the general economy and has been increasingly linked to emerging countries, where the improvement in living standards is driving an increasing use of packaging, films, and textile fibres.
3.0 Utility & Off-sites

(a) Chilled water system

The Chilled water system will be designed with a capacity 1000 m³/hr to meet the chilled water requirement of the complex. Chilled water system of the complex will be a closed recirculation system. The chilled water make-up / initial fill requirement of the complex will be met by treated water from existing refinery.

A single Chilled Water package is considered for Petrochemical complex which will provide water to the process units. After removing heat from the required process streams, the chilled water is returned to the Chilled Water System where it is cooled to the supply temperature.

(b) Cooling water system

The Cooling water system will be designed to meet the cooling water requirement of the complex. Cooling water system of the complex will be a closed recirculation system.

Cooling water from the cooling tower basin is sent to the cooling water pumps to provide cooling water to various users. After removing heat from the required process / utility streams, the cooling water is returned to the cooling towers and is cooled to the supply temperature in the cooling tower. Chemical dosing packages such as anti-scalant dosing and biocide are used in the closed cooling water system to minimize the corrosion and algae formation.

(c) Demineralized (DM) water system

The Demineralized Water Plant will be designed to meet the requirement of the complex. The DM Water Plant receives treated water from the IREP Plant. The water from the DM water plant will be stored in the DM Water Tanks and finally pumped with the help of the DM Water pumps to the deaerator in the Power and Steam Plant and to all the other users in the complex.

(d) Fire water system

The estimated firewater requirement for the complex will be based on water demand considering the highest for two major fires simultaneously in complex.

Firewater distribution network along with hydrants, monitors and deluge water systems shall be provided throughout the complex according to the hazard assessment. Adequate firewater storage and pumping capacity shall be made available to deliver the design flow rate and pressure at the battery limit tie in point between refinery and proposed petrochemical complex.
(e) Flare system

The Plant shall be adequately protected from all sources of overpressure by providing relief systems and relief paths or, where justifiable, other means of overpressure protection. The objective of the Flare System for the Complex is to collect vent and relief streams from the complex and safely direct them to disposal via combustion in the flare. Flare knockout drum shall be provided to remove liquid from relieving gas to avoid any liquid release to flare stack. The vessel shall be sized for the maximum design gas load. The Flare System shall have dedicated flare KO drum pumps to transfer the liquids from the Flare KO Drum to the slop tanks.

Water Seal Drum shall be provided for the flare. The water seal drum integrated with the flare stack prevents any flashback originating from the flare tip from propagating back through the flare system, maintains a positive system pressure to ensure no air leakage into the flare system and prevents air ingress into the flare system due to sudden temperature changes or condensation of flare gas.

(f) Fuel gas system

The Fuel Gas System will be designed to ensure collection and distribution of imported natural gas as well as indigenous fuel gas to meet the demands of the complex during normal operation as well as start-up and certain emergency conditions.

Natural gas will be used in the complex to produce the power and steam. Fuel gas for Gas Turbine Generator and Auxiliary boilers is supplied by process off gas.

Fuel gas generated from the complex is routed to Fuel gas KOD and distributed to various users. Natural gas is provided as a back-up for fuel gas.

(g) Nitrogen and oxygen system

The Nitrogen & Oxygen system will be designed to meet the start up and continuous requirement in the complex and based on the technology route selected.

(h) Potable water system

Potable water in the complex shall be used in safety showers/eye washers and for the personnel use. Potable water pumps shall be connected to the emergency power supply to facilitate uninterrupted water supply to eye wash and safety shower during power failure.
(i) Steam and power system

The Power and Steam system will be designed to fulfill the power and steam requirement of the complex. Power will be sourced from the state grid and supplemented by internal generation through Gas turbines / Back pressure STG’s. Boilers have been considered for steam generation.

For Power generation through GT’s, if required, fuels such as Natural gas/ fuel gas/Naphtha/ HSD etc. will be considered. Additionally, Back- Pressure/Extractive STG will be used to produce extra power from the HP steam by extracting some MP/LP steam. Emergency diesel generators will be provided as required, to run the emergency drives and UPS.

Condensate generated in the complex is recovered and treated in condensate polishing unit for reuse to reduce the requirement of make-up Demineralized Water (DM) for steam production. Treated condensate and make up Demineralized Water are treated in the Deaerator to remove oxygen, carbon dioxide and other non-condensable to produce Boiler Feed Water (BFW). Oxygen scavenger and amine are injected in the discharge line from the Deaerator to capture the dissolved oxygen in the BFW and also to maintain the pH of the BFW at the desired level, respectively. BFW is used for steam generation in the Complex and also for desuperheating.

The Power and Steam system will be further optimized after receipt of Licensor engineering packages

(j) Tempered water system

The Tempered water system will be designed to meet the tempered water requirement of the complex. Tempered water system of the complex will be a closed recirculation system. The tempered water make-up / initial fill requirement of the complex will be met by treated water from existing refinery.

(k) Treated raw water system

The treated water will be supplied to the complex from a new source being identified by BPCL. The total estimated requirement of treated water in the complex is 1260 m³/hr.

Treated Raw water is primarily used for producing demineralized water and also as cooling water system makeup. In addition, Treated Raw water is distributed to various users such as fire water make up and utility (plant) water etc.
(1) Waste water system

The waste water system will consist of Waste Water Treatment Package, Spent Caustic Treatment Package, Sanitary Waste Treatment Package and Reverse Osmosis Unit Package.

Waste Water Treatment Plant will be considered to treat Process waste water and oily waste water from various process/utility units and Sanitary Waste/Sewage. Non-oily rain water shall be collected in an Impoundment Basin separate from process and oily waste water to avoid contamination. This shall run to Waste Water Treatment Plant for first 15 minutes and then directly sent to storm water sewage pond.

Spent Caustic Treatment Plant is to treat spent caustic, from various process units. Spent Caustic generated is collected and routed to the common Spent Caustic Treatment Plant. Sanitary Waste Treatment Plant is used for Biological treatment of sanitary waste generated within the complex from toilets and washrooms consisting of general human waste. Pre-treatment of waste water generated from various units shall be done in the respective units prior to routing it to Waste Water Treatment Plant.

The Clarified Water from WWTP, SCTP and SWTP is sent for further purification to a common RO system.

4.0 Raw material and Product Handling / Storage system

The storage system will be designed for the storage of feedstock, intermediate products, final products and bulk process chemicals. Storage capacity is based on the process unit feed/product rates, the criticality of operation, turnaround schedules, catalyst regeneration schedules, etc. Hydrocarbon liquid storage tanks and pumps are categorized as follows:

(a) Feed storage and pumping

Propylene which is the main feed stock is coming from existing refinery storage area during normal operation, so there is no requirement of additional storage for PO unit. Two (2) propylene transfer pumps (2 x 100% @ normal operation, one working and one spare), are considered for pumping stored propylene to PO Unit.

Off gas compressor will be provided to supply refinery off gases to Ethylene recovery unit.

Intermediate product storage and pumping

The intermediate storages are provided so that the high reliability is achieved for continuous operation of the plant. Intermediates storage is to absorb unbalances in producing and consuming units for having space and sufficient stock available. The
following products are the intermediates viz. Propylene Oxide, Ethylene Oxide and Ethylene which are required to be stored. Cryogenic facilities are being considered to store these intermediates.

(b) Finished product storage and pumping

The Product tanks are provided to store the finished products from the units. The products will be dispatched from Product tanks to marketing terminals and then for sale via drumming and trucks to their respective consumers. The following are the Products for which the storages are considered.

- Polyols (different grades)
- Propylene Glycol, Di-Propylene Glycol (DPG), Tri-Propylene Glycol (TPG)
- Mono Ethylene Glycol (MEG), Di-Ethylene Glycol (DEG) & Tri-Ethylene Glycol (TEG)

Other storage and pumping (covers Chemical & Catalyst)

There are number of chemicals required by proposed project. They will be supplied by trucks. The chemical & catalyst transfer from truck to tank by flexible hose connected to truck and unloading pump. The unloading pumps, storage tanks and transfer pumps will be required for other raw materials such as Sorbitol, Glycerine, Caustic etc.

(c) Logistics

The material handling system of the complex will be designed considering two types of transportation; via truck unloading/loading and on-site piping. Propylene which is the main feed stock will be supplied via on – site pipeline from existing propylene storage bullet in the BPCL – Kochi refinery. Whilst truck unloading/ loading arm are required for catalyst, chemicals, monomers and solvent are unloading and product loading. The proposed complex product loading options are divided into drumming and truck loading.

The chemical, catalyst and Initiators unloading from bottom of truck to tank by flexible hose connected to truck and unloading pump.

Loading bays / stations are loading and unloading points for road vehicles e.g. Tank trucks which are used for loading or unloading of liquid products. The loading arm will be provided with the shutdown valve interlock with level in the truck tankers. This interlock will close the shutdown valve on the loading arm once the high level is reached in the truck tankers.

Polyols are not classified for physical hazards. They are not flammable but will burn. It is slightly hygroscopic and must be stored under conditions that prevent contamination with
water or absorption of moisture. They are not classified for health or environmental effects and are generally considered as low hazard products. Hence, there are no specific regulations for transportation of polyols. It can be transported via road, rail, sea or air and is considered as a non-hazardous material therefore, not regulated under any class of dangerous products or packaging group. Polyols are very sensitive to oxidation during storage and transport and the use of appropriate stabilization systems will protect not only the polyol building blocks but also the finished polymer during its service life.

Propylene glycol is a clear, colorless, slightly syrupy liquid at room temperature. It is miscible fully in water, acetone, ethanol, chloroform, diethyl ether. Propylene Glycol is considered as non-hazardous hence, not classified under any class and packing group. PG’s are sensitive to UV light, which can act as a radical initiator and initiate oxidation reactions. For this reason, it is stored in opaque containers.

MEG is a colourless, odourless, and slightly viscous liquid, hygroscopic and miscible with water in all proportions. As MEG is available and transported in liquid state hence, loading and transportation is conducted in closed containers to prevent release from the system. There are no special regulations for MEG as it is not regulated under International Transport Regulation: ADR/RID (Road/Rail), IMDG (Sea) and ICAO/IATA (Air) therefore, it can be easily transported via road/rail, sea or air and for smaller shipments, iso-containers or drums are used.

Drum filling for Polyols, MEG, DEG, TEG, PEG, PG, DPG and TPG will be considered.

5.0 Proposed Site

The overall plot area requirement for the complex is approximately 200 acres, out of which 170 acres located close to the refinery, is being acquired from FACT. It is proposed to acquire another 150 acres from FACT, if required during detailing. Plot plan will consider green belt based on prevailing statutory guidelines. For the initial conceptual plot plan development the process units will be arranged in Block B1 and utilities in Block B2. The relative placement takes in to account interdependency of different units to optimise the piping runs.
Site Map