RELIANCE INDUSTRIES LIMITED,
Dahej Manufacturing Division (DMD), Gujarat

Pre-Feasibility Report

for

Debottlenecking & Expansion of Petrochemical Plant

March 2016

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1. INTRODUCTION

Introduction

Reliance Industries Limited, India's largest private sector company, now operates at Dahej, a Petrochemical plant formerly set up by Indian Petrochemicals Corporation Ltd. (IPCL), a pioneer in the petrochemicals sector. Availability of adequate gas and condensate feedstock from Gandhar oil and gas fields has led IPCL to set up and commission a Gandhar petrochemical plant in 1996, after obtaining clearance from MoEF in 1991, comprising of a state-of-the-art gas cracker unit and other downstream units at Dahej in Bharuch District in the state of Gujarat. The Gandhar petrochemical plant consists of the following existing plants & related utilities which are in operation.

- Vinyl Chloride Monomer (VCM)
- Poly Vinyl Chloride Unit (PVC)
- Chlor-Alkali Unit (CA)
- Gas Cracker Unit (GCU)
- Ethylene Oxide/ Ethylene Glycol Unit (EO/ EG)
- High Density Poly Ethylene Unit (HDPE)
- Ethylene Vinyl Acetate (EVA)
- Ethane Propane Recovery Unit (EPRU)
- Purified Terephthalic Acid Unit (PTA)
- Polyethylene Terephthalate (PET)
- Utilities including Captive Power Plant

RIL-DMD is currently planning expansions of its production capacities by way of de - bottlenecking (DBN) of various plants. This debottlenecking of RIL-DMD plants include **Gas Cracker, Chlor Alkali, Vinyl Chloride Monomer (VCM), Poly Vinyl Chloride (PVC), Ethylene Oxide/Ethylene Glycol, HDPE, Ethylene Vinyl Acetate (EVA)**. This proposal also includes setting up of new plant including **Chlorinated Poly Vinyl Chloride (CPVC), Vinyl Chloride Monomer (VCM), Poly Vinyl Chloride (PVC)** and **Ethane Storage Tank**. The proposed DBN projects and new project are listed in below Table

Proposed Expansion Capacities at DMD

Plant	Capacity (MTA)
Ethylene	2,00,000
Ethylene Dichloride	89,040
Vinyl Chloride Monomer	45,000
Polyvinyl Chloride	45,000
Chlorine	45,800
Caustic Soda	52,850
Ethylene Oxide	30,000
HDPE	20,000
Ethylene Vinyl Acetate (EVA)	2,000
New Additions	
Chlorinated Poly Vinyl Chloride (CPVC)	70,000

Vinyl Chloride Monomer (VCM)	12,00,000
Poly Vinyl Chloride	12,00,000
Ethane Storage Tank	90,000Tons

The product profile as well as the list of byproducts produced at DMD is given in below tables;

Product Profile

Product	Production (MTPA)		
	Existing	Proposed	Total
Ethane/Propane	650000	0	6,50,000
Ethylene	5,00,000	**2,00,000**	7,00,000
Propylene	1,60,000	0	1,60,000
Ethylene Dichloride	4,98,960	**89,040**	5,88,000
Vinyl Chloride Monomer	3,15,000	**45,000**	3,60,000
Polyvinyl Chloride	3,15,000	**45,000**	3,60,000
Chlorine	1,41,200	**45,800**	1,87,000
Caustic Soda	1,68,150	**52,850**	2,21,000
EO	20000	**30000**	50,000
EG	308350	0	3,08,350
HDPE-I	160000	**20,000**	1,80,000
HDPE-II	60000	0	60,000
UHMW-PE	2500	0	2,500
Ethylene Vinyl Acetate (EVA)	13000	**2000**	15,000
PTA	3000000	0	30,00,000
PET	10,00,000	0	10,00,000
Polyester Complex a. Polyester Staple Fiber b. Polyester Fiber Yarn	8,00,000	0	8,00,000
Pure Ethylene Oxide	200000	0	2,00,000
Ethanol Amines	60000	0	60,000
Glycol Ethers	60000	0	60,000
Glycol Ether Acetates	30000	0	30,000
Ethoxylates – Ethylene Oxides Condensates	200000	0	2,00,000
Crude Acrylic Acid	160000	0	1,60,000
Glacial Acrylic Acid/High Purity Acrylic Acid	40000	0	40,000
Butyl Acrylate	120000	0	120000
Ethyl Acrylate	20000	0	20000
Methyl Acrylate	20000	0	20000

2 Ethyle Hexyle Acrylate (2EHA)	40000	0	40000
Phenol	250000	0	250000
Acetone	155000	0	155000
Captive Cogeneration Power Plant			
a. Gas Based	195 MW	0	195 MW
b. Coal Based	270 MW	0	270 MW
Chlorinated Poly Vinyl Chloride	**New Project**	**70,000**	70,000
VCM	**New Project**	**12,00,000**	12,00,000
PVC	**New Project**	**12,00,000**	12,00,000
Ethane Storage Tank	**New Project**	**90,000 Tons** (1 Tank)	**90,000 Tons**

Byproducts

Products	**Production (MTPA)**		
	Existing	**Proposed**	**Total**
Mixed C4 +	40000	**7450**	47450
RARFS (Pyrolysis Gasoline)	40000	**14750**	54750
Fuel Oil	40000	0	40000
Tar Residue	5472	0	5472
HCL (from existing VCM + New VCM Plant)	36000	**1,20,000**	1,56,000
Sodium Hypochlorite	8,400	**2,600**	11,000
Dilute H_2SO_4	3530	**1,070**	4600
HCL (CA)	9600	**5,400**	15,000
Di Ethylene Glycol	30550	0	30550
Tri Ethylene Glycol	1270	0	1270
PEG	19850	0	19850
TEG Bottom	2880	0	2880
Crude Benzoic Acid Mix	60000	0	60000
Light Ends	0	**15,600**	15,600

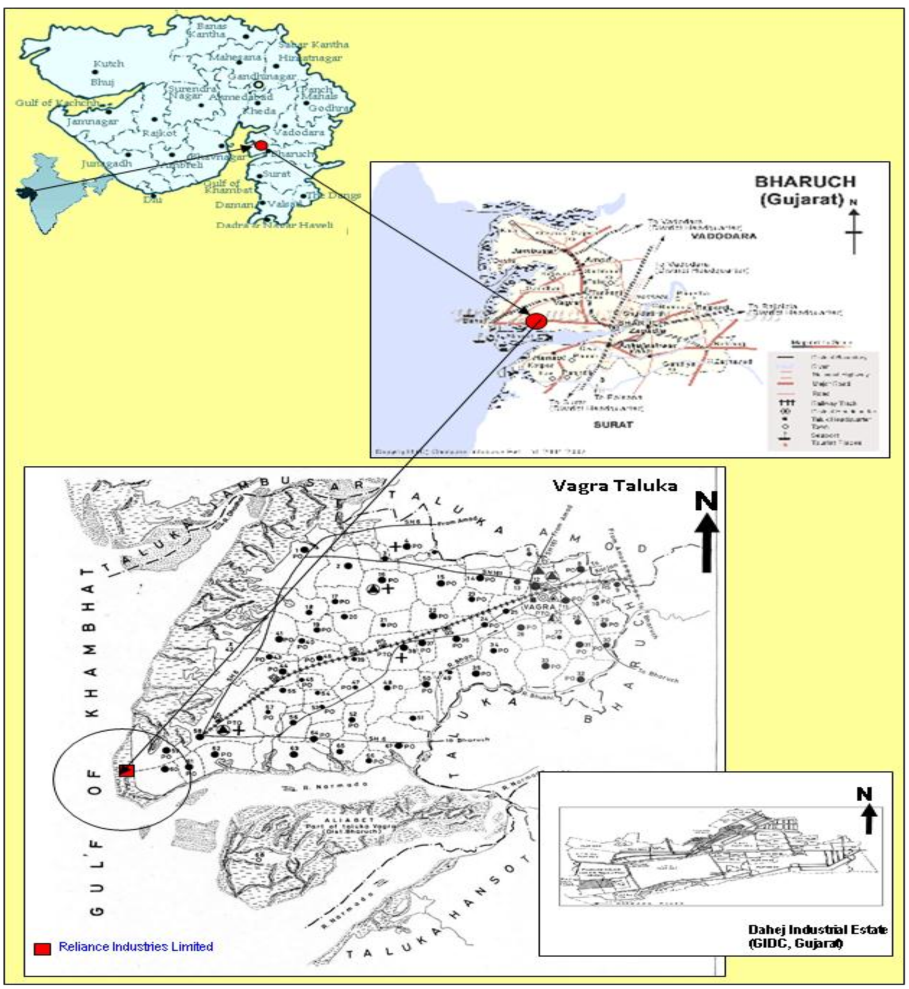
Need for Environmental Clearance & Categorization of the Project

As per the Environmental Impact Assessment (EIA) notification of 14th September, 2006 and its amendments, prior Environmental Clearance (EC) is required to be obtained prior to construction of the proposed projects. The proposed project involves processing of petroleum fractions & natural gas in the Gas Cracker. Hence, as per the EIA Notification 14th September, 2006, the proposed project comes under Schedule '5(c)' and categorized as 'Category A' projects.

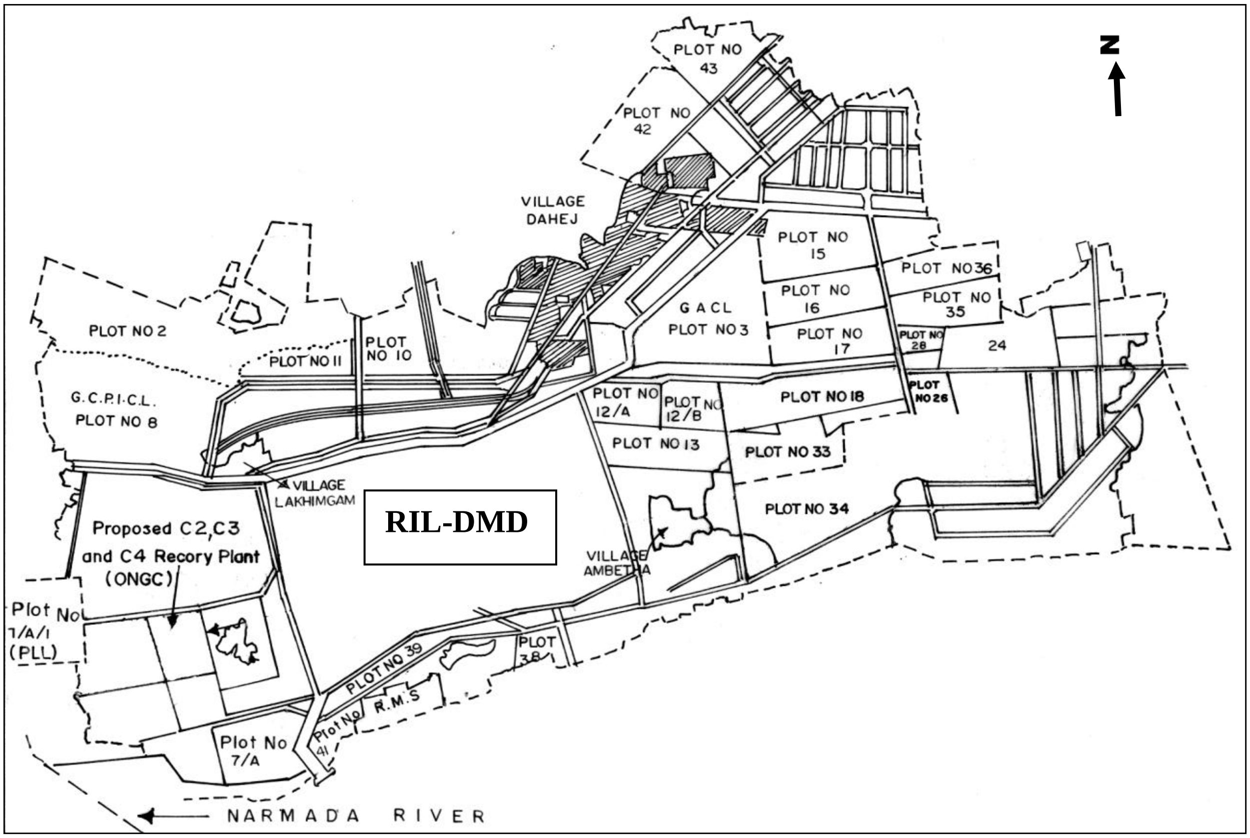
2. SITE ANALYSIS

Location / Project Siting

The proposed project is planned within the DMD site for better integration with the existing infrastructure facilities available there. This will enhance the operational flexibility and manufacturing synergy. This will enable optimized usage of resources thereby reducing the pollution load on the environment with reduction in transportation facilities as well as for the infrastructure required for manufacturing facilities. The DMD site is flanked by the villages Ambheta, Jageshwar and Lakhigam in Vagra Taluka of Bharuch District, Gujarat state between latitudes of 21^{0}40’35”N and 21^{0}41’27”N and longitudes of 72^{0}33’32”E and 72^{0}35’04”E. The far eastern part is surrounded by plains and the western flank is marked by coast line. The location map of DMD is given below. DMD sprawls over 700 hectares of land, out of which ~ 231 hectares is earmarked for greenbelt which will be strengthened further and maintained. Thus, ~ 33 % of total land within DMD is covered by greenbelt.



Location Map DMD



DMD Boundary within GIDC Industrial Area

Connectivity

The proposed project is planned within the existing DMD site for better integration with the existing infrastructure facilities available at DMD, required for the project. The DMD site is located in Bharuch District in Gujarat state. The proximity to port facilities off coast of Gulf of Khambhat are added advantages with respect to raw material unloading and product dispatches. The NH-8 connecting Ahmedabad & Mumbai is ~43 Km from the site. The nearest rail station is at Baruch situated ~43 km from the site & the nearest airport is Vadodara Airport which is at a distance of ~95 km.

Climatic conditions

At Dahej the climate is hot & humid, influenced by surrounding estuary and sea. The maximum temperature during summer and minimum temperature winter are 40ºC and 12ºC respectively. Predominant wind direction varied from South & South-West and North-East direction and average rainfall us about 1200 mm.

3. PROJECT DESCRIPTION

Project Information

Dahej Manufacturing Facility (DMD) - Reliance Industries Limited (RIL) is proposing to debottleneck the existing plants which includes **Gas Cracker (GC), Chlor Alkali (CA), Vinyl Chloride Monomer (VCM), Poly Vinyl Chloride (PVC), Ethylene Oxide/Ethylene Glycol (EO/EG), HDPE, Ethylene Vinyl Acetate (EVA)**. This proposal also includes setting up of new plant including **Chlorinated Poly Vinyl Chloride (CPVC), Vinyl Chloride Monomer (VCM), Poly Vinyl Chloride (PVC) and Ethane Storage Tank**. These plants will be located within the existing RIL DMD. The existing DMD is spread over 700 hectares and there is sufficient vacant space to accommodate these proposed projects.

Project Justification

Gas Cracker plant is the mother plant of RIL-DMD which produces Ethylene and Propylene as a product and the same is used as a raw material in downstream plants. At present, major feed stock for cracker is from the ONGC Ghandhar field and propane is either imported or from RIL refinery at Jamnagar. A continuous reduction of feed stock supply from ONGC is envisaged. In view of reducing feed gas availability an alternative feedstock had to be identified to maintain the market leadership in Petchem sector and also to sustain operation of Cracker as a long term solution. Now, in view of Shale gas ethane availability it is planned to create flexibility of cracking ethane in the process and increase existing plant capacity. The cold energy of the ethane will be utilized for increasing the capacity of the Gas cracker unit to produce more ethylene. This additional ethylene will be utilized in the existing operating unit to increase the capacity marginally by way of debottlenecking.

Further, the need for petrochemical products and the following important features, justifies the project to be undertaken by DMD-RIL. The following features also justify, DMD as the best alternative as regards to project site, infrastructure, connectivity, facilities for export/import and market potential.

- DMD is located within the GIDC declared Industrial area
- The product manufactured meets market expectations
- Adequate safety systems are built in the design to handle operational upsets
- Availability of required land for the proposed expansion within DMD
- Location connectivity by rail /road within the country and sea route for export/import
- Availability of infrastructure facilities
- Availability of infrastructure for raw water pumping from Narmada river
- Availability of electric power through captive power plant
- Availability of onsite and offsite facilities
- Market potential for the finished products
- Environmental management:
    - Existing plants already have robust management systems for quality, environment and occupational health and safety which are certified against the standards ISO 9001, ISO 14001 and OHSAS 18001 respectively.

- Established EMP and DMP.
- The wastewater from proposed project will be treated in the existing ETP.
- The surplus effluents after recycle/reuse from the present plants in operation and proposed project will be discharged through a multi-port diffuser in the Gulf of Khambhat. The existing multi-port diffuser has sufficient capacity to handle the effluents, both from the existing and proposed projects.
- Dahej Manufacturing Division is a member of the nearest TSDF Site located at BEIL, Ankleshwar, which can accommodate additional quantity of hazardous waste, although negligible, that will be generated due to proposed project.
- Greenbelt development: There exists at DMD a well-established greenbelt of ~ 33% of total land area, which is adequate for attenuation of air emissions and noise levels.

Project Area

DMD is declared as industrial area as per notification from Govt. of Gujarat. The industrial area notification is shown at **Annexure-3.** The site layout map showing the existing plant installation and the location of the proposed installation in the project site is given in **Annexure –2**. The area breakup of DMD is given in below table.

Land Break-Up

Facilities		**Area (in hectares)**
i.	Process Plants, Utilities, Captive power plant, Tank farm and Storage facilities including new plants VCM, PVC, CPVC & Ethane Storage Tank	320
ii.	Open areas, Roads, Approaches and Safe distances, future expansion, landscaping	149
iii.	Greenbelt	231
	Total	**700**

Employment Generation due to the project

The existing manpower at DMD is ~1933 (supervisory: 1366 and non-supervisory: 567). Existing manpower would be used, as most of the projects are DBN of existing plants. For the proposed new plants of CPVC, VCM, PVC & Ethane Storage Tank ~300 persons will be employed on regular basis. During the construction activity envisaged for the CPVC, VCM, PVC & Ethane Storage tank local labor from the nearby region will be employed based on skill sets.

Project Cost

The proposed activities will be carried out within the existing DMD plant. Hence, no additional land is required for the proposed project. However the CAPEX would involve the construction activities such as foundations & procurement along with machinery installations for the new plants. Environment Protection and safety systems have also been considered in planning the cost projection. Capex for the proposed project is ~ Rs. 13,250 crores.

4. PROCESS DESCRIPTION

The Ethane which is proposed to be imported shall be the raw material for the Gas Cracker plants. From the Gas Cracker (GC), the products ethylene & propylene will go as feeds to downstream plants such as EO/EG, VCM, HDPE etc. the following section provides the details of the proposed project.

The liquid ethane will be purged to the existing GC Unit to recover the cold energy. Minor debottlenecking will also be carried out in the Gas Cracker Unit. Debottlenecking will be to the effect of installing heat exchangers, revamp of trays in the columns & pumps.

The additional ethylene obtained in the GC units will be used in the existing units by carrying out minor capacity enhancement in each of them which is as given below:

- **Gas Cracker (GC) Unit** – The ethylene capacity is expected to increase from 5, 00,000 to 7, 00,000 MTPA by importing Shale gas ethane. When shale gas ethane is not economically viable propane will be cracked which is expected to result in mixed C4 production from 40,000 to 47,450 MTPA and RARFS from 40,000 to 54,750 MTPA.

- **Chlor Alkali (CA) Plant** – It is proposed to increase the Cl2 production from 1, 41,200 MTPA to 1, 87,000 MTPA so as to produce EDC in-house in VCM plant. This will enable us to utilize some of the ethylene available from Gas Cracker Unit and also reduce import of ethylene dichloride. Correspondingly the Caustic Soda production is also expected to increase from 1, 68,150 MTPA to 2, 21,000 MTPA, Sodium Hypochlorite from 8,400 MTPA to 11,000 MTPA and HCL from 9,600 MTPA to 15,000 MTPA.

- **VCM Plant** – It is proposed to increase the EDC (Ethylene Dichloride) manufacturing capacity from 4, 98,960 MTPA to 5, 88,000 MTPA by doing debottlenecking in the existing plant. Thereby, it is also proposed to debottleneck existing Vinyl Chloride Monomer production from 3, 15,000 MTPA to 3, 60,000 MTPA.

- **PVC Plant** – It is also proposed to debottleneck Polyvinyl Chloride production from 3, 15,000 to 3, 60,000 MTPA to utilize the additional VCM available.

- **EO/EG Plant** – It is proposed to increase the ethylene oxide capacity from the plant from 20,000 MTPA to 50,000 MTPA. This will give us a business flexibility to switch between ethylene glycol and ethylene oxide depending on market capacity.

- **EVA Plant** – It is also proposed to increase the Ethylene Vinyl Acetate plant capacity from 13,000 MTPA to 15,000 MTPA with minor debottlenecking.

- **HDPE Plant** – It is proposed to increase the High Density Poly Ethylene Unit plant capacity from 1,60,000 to 1,80,000 MT.

In addition to the above mentioned modification, it is also proposed to setup new plants such as CPVC of 70,000 MTPA as a value addition to existing PVC product, new plants to produce VCM & PVC is proposed to be setup with a capacity of 12,00,000 MTPA each and an Ethane storage tank of 90,000 tones is proposed. The brief description of the new plants are given at the end of this section.

The following section briefly describes the modifications planned for the each of the above plants and process description of the same;

Gas Cracker (GC) Unit:

The Process:
GC produces Ethylene, propylene and other by-products by pyrolytic cracking of Ethane, Propane.

Feed Handling Section: The Ethane is fed to the cold recovery system and then supplied to the furnace. The ethane and propane streams are separately supplied to the cracking furnaces.

Pyrolysis Furnace and Hot Section: The feed stock is mixed with steam and cracked to the desired severity to exercise some control over product pattern. The coil effluents are rapidly quenched in a battery of Ultra Selective exchangers (USX). Furnace effluents then pass through transfer line exchanger for supper HP steam production. It is then sent to the water quench tower for cooling by direct contact with water. The light fuel oil is separated from water in an oil-water separator. LFO is sent to the mixed oil storage along with Fuel oil. The overhead vapour from the quench tower is sent to the cracked gas compressor through the suction drum.

Cracked Gas Compression, Acid Gas Removal and Dehydration: The cracked gas is compressed in a four stage centrifugal compressor, each stage of which is provided with a water cooled intercooler. Acid gas removal by circulating caustic wash is done between 3rd & 4th stages of compression. Overhead from the 4th stage discharge drum flows to the cracked gas dehydrators, which are filled with molecular sieves.

Chiling & Demethanization: The dried cracked gas is chilled by propylene to condense out most of the C3's and heavier components. This condensate is stripped in the demethaniser prestripper column so that only trace quantities of methane remain in the bottom stream. That bottom stream is fed directly into the de ethaniser. The remaining gas is then successively cooled by ethylene refrigeration to –65°C and –98°C. Condensate is fed separately to the demethaniser. The tower separates methane from C2 and heavier bottoms streams. The net overhead from the demethaniser tower system is further rectified in demethaniser overhead rectifier to minimize ethylene loss. The residue gas stream, which contains predominantly hydrogen and methane is expanded through expanders to chill feed and is then compressed and sent to fuel gas. A pressure swing adsorption (PSA) system is provided to produce hydrogen of 99.99% purity.

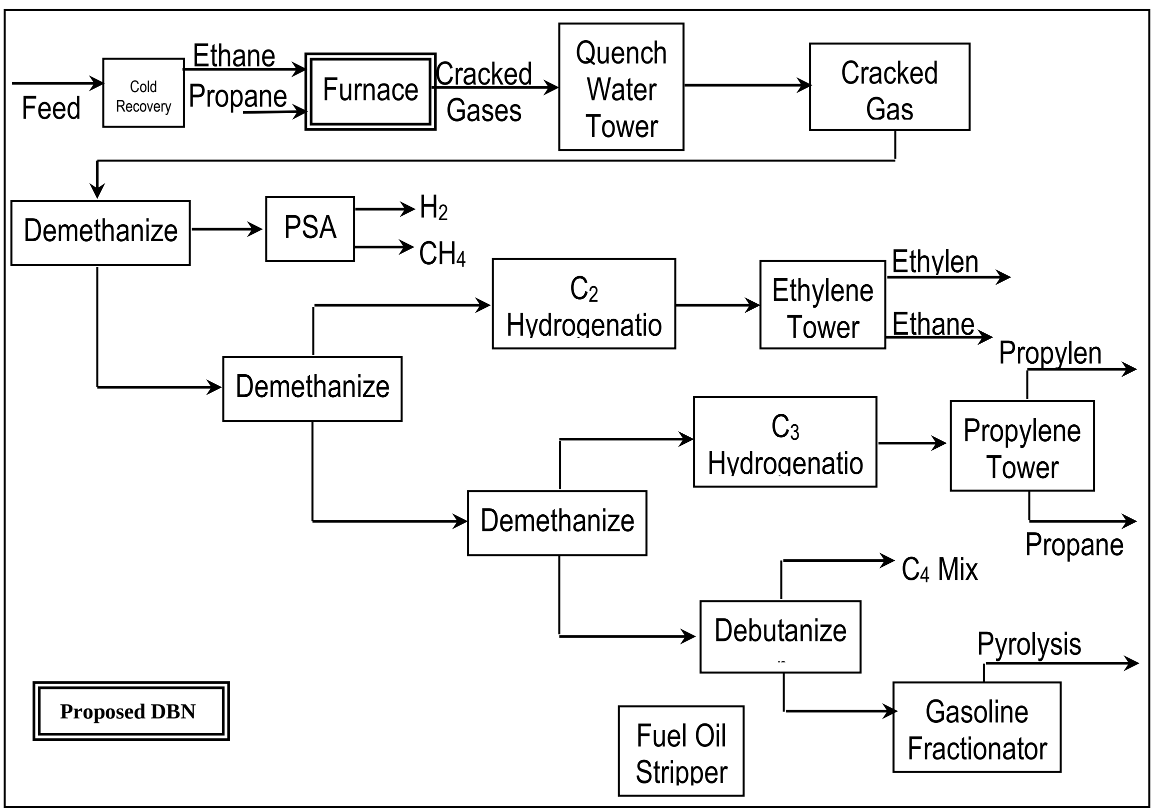
Fractionation and Acetelylene Hydrogenation: The de-ethaniser separates the demethaniser net bottom streams into a C_2 overhead stream and C_3 & heavier bottom stream. The net bottom stream is cooled and fed to depropaniser. The net overhead steam (mainly ethylene, but small quantities of acetylene and ethane) is taken to the acetylene hydrogenation system where acetylene reacts with hydrogen and converted into ethylene in presence of catalyst. The feed is split in ethylene tower to get ethylene product as the overhead stream. The bottom stream, which is predominantly ethane, is recycled for cracking to produce more ethylene. The depropaniser is fed by de-ethaniser bottoms. The feed is fractionated to produce C_3 overhead stream and C_4 & heavier bottom stream. Overheads are pumped to the MAPD hydrogenation system. The methyl acetylene and propadiene in the propylene/propane net overhead by selective liquid phase catalytic hydrogenation in MAPD reactors get converted to propylene and propane. The bottoms from the depropaniser goes as feed to the debutaniser, where it is separated into a C_4 overhead stream and a C_5 & heavier bottoms stream. C_4 mixed product is withdrawn as an overhead stream and pumped to battery limits. Debutaniser bottoms are sent to the upper feed tray of the gasoline fractionator, which separates fuel oil components (at bottom) from the pyrolysis gasoline.

Refrigeration: The refrigeration requirement of the plant at different temperature levels is provided by refrigeration systems with ethylene and propylene as refrigerants.

Ethylene Surge Drum: Ethylene product from 8^{th} tray of ethylene tower is collected in surge drum under gravity flow. Ethylene product is pumped for supply to EOEG, VCM plants. HP ethylene is supplied at 30 kg/cm²g. The balance is stored at OSBL.

Proposed Modification:

In this project, integration of the Ethane feed system with existing system will take place. The major modification required in Gas Cracker is cold recovery of the Ethane coming at -85°C. The project entails the capacity enhancement of ethylene. To support this capacity enhancement a total of 20 exchangers, 9 drums and 3 pumps are being added. 4 column trays are being replaced for higher capacity. One furnace will be added in the project with a stack of ~38 m.



GC Process Flow

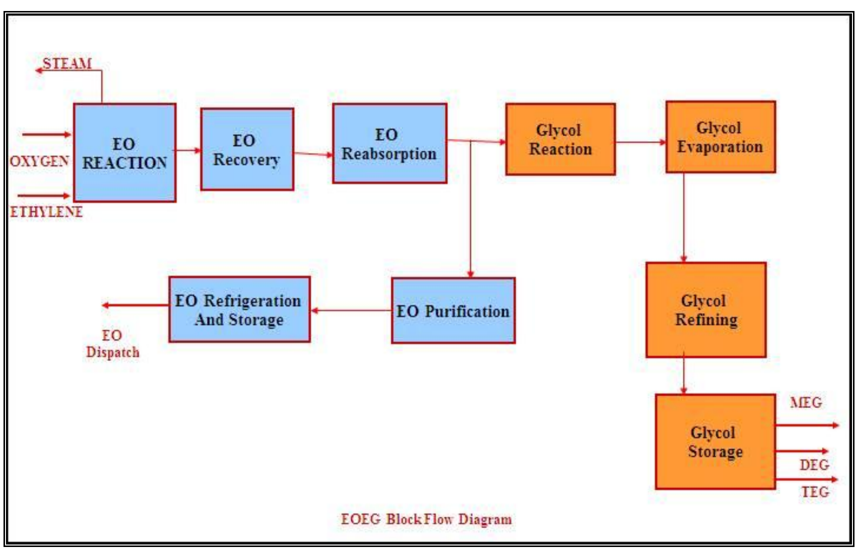
Ethylene Oxide (EO)

The Process

- Ethylene and Oxygen reacts to form Ethylene oxide under catalysed condition in EO Reactor.
- Then EO is scrubbed out with water and Carbon Dioxide has been removed as an impurity in separate CO2 Removal Unit.
- Rich cycle water containing Ethylene oxide goes to EO Stripper and then overhead gas again absorbed in Water and specific ratio of EO to water is being maintained. The column bottoms containing the EO and water mixture transferred to Glycol Feed Stripper where some dissolved stripped off and bottom transferred to Glycol section and EO purification section as feed.
- Feed is preheated before entering the Purification Column where ethylene oxide is distilled and taken as a side stream product and sent to the Ethylene Oxide Storage Section.
- The column bottoms containing the stripped water are recycled to the Reabsorber.
- Purified Ethylene Oxide from the Purification Column is cooled in the Oxide Product Cooler to -5 oC using a refrigerated 50/50 wt% glycol solution and then stored in the Ethylene Oxide Storage Bullets.
- The Ethylene Oxide is maintained at -5 oC by circulating the Ethylene Oxide through the Oxide Storage Coolers which used a refrigerated 50/50 wt % glycol solution as coolant.
- The recirculation is provided by Ethylene Oxide Transfer Pumps which are also used to pump the Ethylene Oxide to the Ethylene Oxide Loading Arms.

Proposed Modification:

It is proposed to increase the ethylene oxide capacity from the plant from 20,000 MTPA to 50,000 MTPA. This will give us a business flexibility to switch between ethylene glycol and ethylene oxide depending on market capacity.



EO Process flow

Proposed DBN

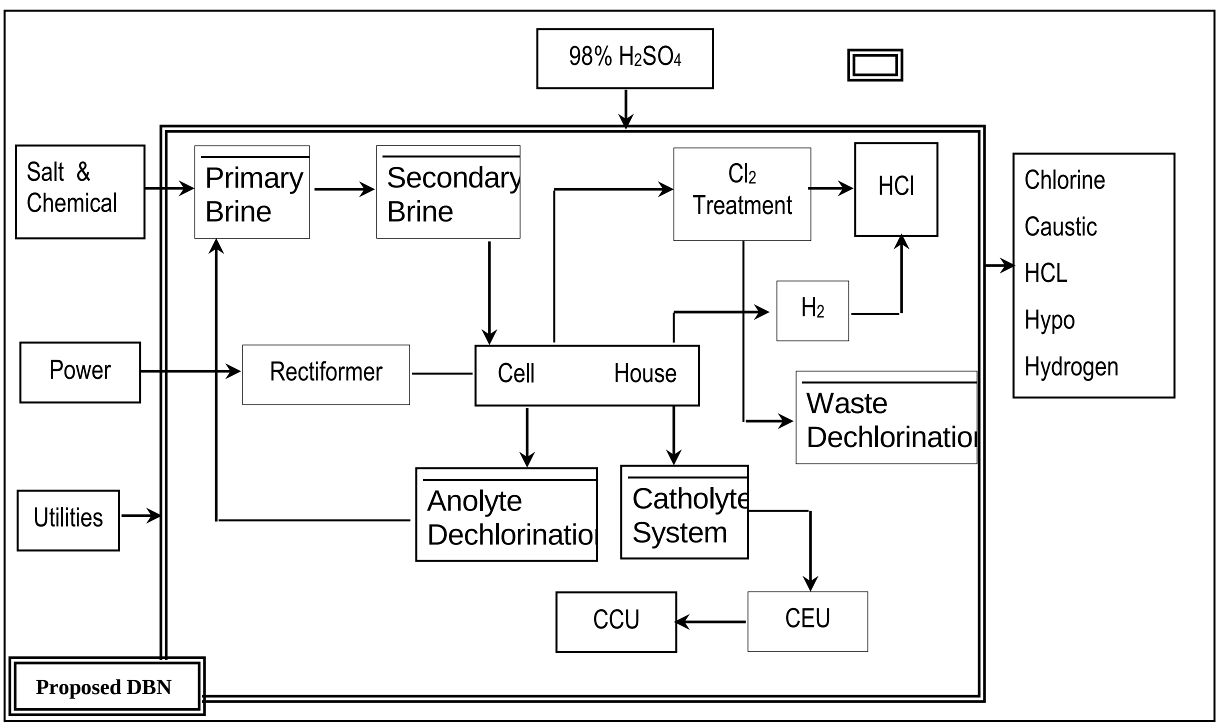
Chlor-Alkali (CA) plant

CA Plant at RIL DMD is based on membrane cell technology supplied by M/s UHDE technology in which Caustic soda and chlorine are produced by means of electrolysis of ultra-pure brine and water.

The process

Sodium Chloride is added to lean brine solution returning from elecltrolysers. This saturated brine solution then flows to precipitation tanks where sodium carbonate, barium carbonate and caustic soda solution are added. At this stage, the impurities present in common salt are precipitated. From precipitation tank the brine solution overflows to clarifiers where flocculent solution is added to improve settling of precipitated solids. The clarified brine is then filtered in two stages to remove residual solid impurities and thus polished brine is obtained.The polished brine is sent to cation exchange columns in order to remove calcium and magnesium cations as impurities. The brine then finally passes through brine heat exchangers to brine overhead tank.
The purified brine is fed to the anode compartment of electrolytic cells where chlorine gas and weak brine are produced, while deionized water is fed to cathode compartment where caustic soda and hydrogen gas are generated as follows:

$$2NaCl + 2H2O \longrightarrow 2NaOH + Cl2 + H2$$



CA Process Flow

Proposed Modification:

Expansion of CA plant has following Justification:

- After the commissioning of New project of CPVC the requirement of chlorine will increase by 125 MT/Day.

- Up gradation of existing electrolyzes operating at 3.94 KA/m2, which can operate at higher current density of 6 KA/m2 giving improved margins.

Description:

Expansion from 168150 MTPA to 221000 MTPA caustic (Considering the additional chlorine requirement by CPVC plant). Expansion of existing plant by 52850 MTPA by addition of one more rectifier parallel with existing rectiformer system and operating existing electrolysers at higher current density approx. 5.0 KA/m2.

- **Secondary Brine** : In Secondary brine section modification required in few equipment's like Chlorate destruction tank , Vacuum tank and Catholyte system.
- **Chlorine Section**: Separate trend of Chlorine processing is required, from outlet of cell house to Chlorine recuparator, Chlorine cooler-I & II, MCF, Drying Tower ,DCF & Chlorine Compressor.(Including separate chlorine liquefaction and evaporation in CPVC project)
- **Cell House**: Addition of elements in Electrolysers, Modification required in bus bar, isolator, Breaker and addition of one more Rectiformer for operating the electrolysers at higher Current density.
- **Hypo Section**: Installation of Stand by Hypo Tower will serve for additional emergency and also act as a final polishing of Hypo.
- **Caustic Evaporation Unit**: 32 % caustic produced in converted to 50 % caustic in caustic evaporation unit. Unit contains three stage evaporation process and in this DNB activity it is envisaged to add an evaporation stage in the process.

Vinyl Chloro Monomer (VCM)

The Process:

Vinyl Chloride Monomer (VCM) is manufactured by balanced process, i.e. all the Hydrochloric Acid produced during cracking of ethylene dichloride is oxychlorinated to ethylene dichloride.

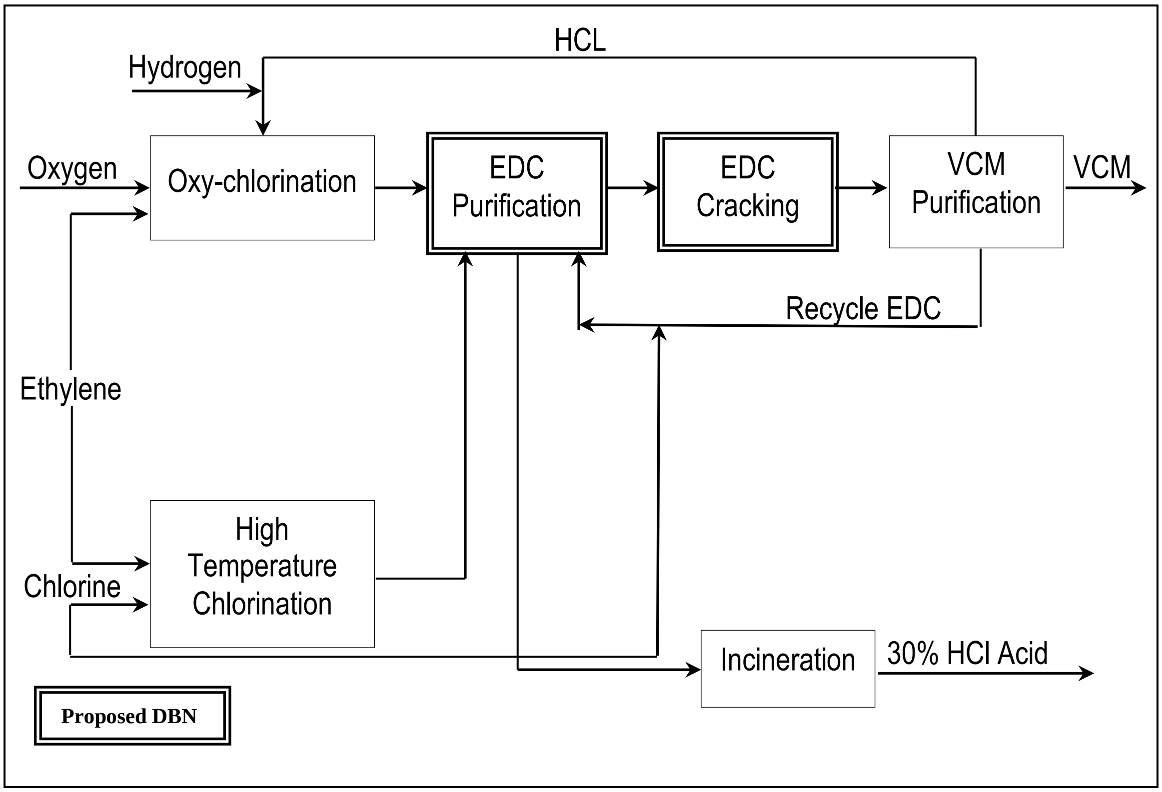
Ethylene Dichloride's (EDC) manufacture involves manufacturing EDC by direct chlorination of ethylene and chlorine. The heat of reaction is utilised to purify dry EDC produced in oxychlorination. Ethylene dichloride is thermally cracked. The cracked product is quenched and purified to produce Vinyl Chloride and Hydrogen Chloride acid gas. The recycle EDC (uncracked EDC) is chlorinated and purified to give furnace feed EDC.

$$C2H4 + Cl2 \longrightarrow C2H4Cl2$$
$$C2H4Cl2 \longrightarrow C2H3Cl + HCl$$

The hydrochloric acid is oxychlorinated with oxygen and ethylene to produce EDC in a fixed bed oxygchlorination system. This EDC is sent to EDC treatment section to produce dry EDC.

$$C2H4 + \tfrac{1}{2} O2 + 2HCl \longrightarrow C2H4Cl2 + H2O$$

The tar (heavy end) from high temperature chlorination, recycle EDC, and quench section are separated. Light end is produced from light end column in EDC wash section. The light end, heavy end, and gaseous effluent from plant is incinerated while aqueous effluent will be stripped off organics in stripper before sending to the central wastewater treatment plant. The incinerator effluent will be scrubbed to recover HCl before venting the gaseous effluent to atmosphere.



VCM process flow

Proposed Modification:
It is proposed to install following equipment for addressing issues limiting to achieve post DBN full capacity i.e. 360000 MTPA of VCM plant.

- Two Additional vertical EDC vaporizer in one of the furnace.
- Replacement of Quench Column bottom CS filters with Monel Clad
- Redesign and installation of new MP steam Desuperheater
- Replacement of Recycle EDC column condenser (which is having CS tubes) with new condenser having tubes of 70/30 Cupro Nickel
- It is proposed to provide the standby steam reboiler in New recycle EDC Column

During the modification process small scale construction is also envisaged like Foundation & structure for new vertical EDC vaporizers, Structure modification for recycle EDC column reboiler

Poly Vinyl Chloride (PVC)

The Process:

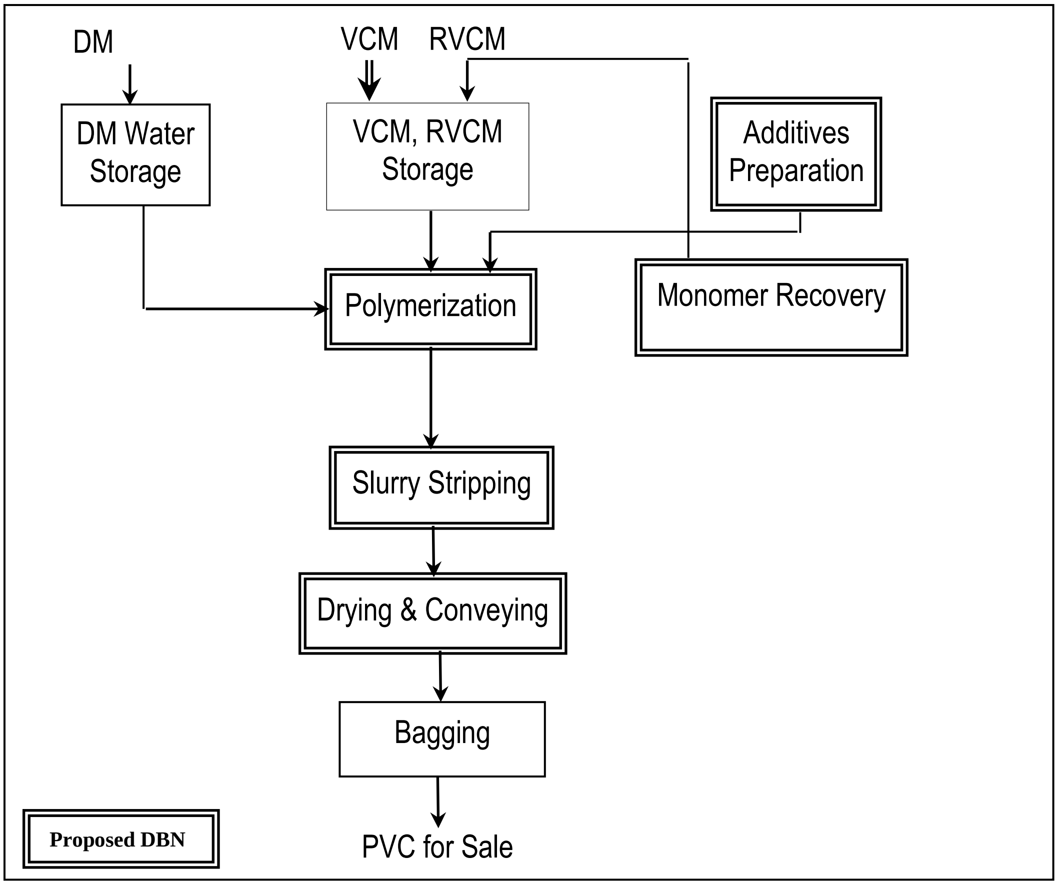
Vinyl Chloride Monomer (VCM) is the raw material required for PVC production and it is received from the VCM plant of RIL DMD. The raw materials required for VCM production are Ethylene and Chlorine. Ethylene is received from GC plant and Chlorine is received from CA plant.

Additives like buffer (suspension in water), cold & hot DM water, VCM, RVCM, Emulsifier, catalyst are charged sequentially into the polymeriser with the agitator running. Heat of reaction is removed by circulating cooling water and chilled water. To maintain constant reactor volume, DM water is injected continuously throughout the reaction to compensate for the volumetric shrinkage. When the desired end point (conversion) is reached, short stop is pumped into the reactor and the reaction is terminated. Nitric oxide, the emergency short stop is used where there is no other way to safely handle the reaction. The PVC slurry is transferred from the polymerisers to the flash tank; and then to the feed tanks where VCM is recovered. Stripped slurry is sent to dryer blend tanks. The wet cake fed to the dryer is dried and conveyed by a hot air stream. The resin out of the dryer is separated from the conveying air in a cyclone separator. The resin from the separator is passed through a magnet to remove metal fragments and on to the vibrating screens. Prime resin passing through the screens is fed to the product hopper. Resin from the product hopper is pneumatically conveyed to check silos (five per train) using the product conveying blowers. Resin that does not pass through the screens is diverted to the tailing box.

Proposed Modification:

For consumption of available VCM raw material, following modification will be carried out:

- New VCM raw material transferring line from VCM plant to PVC plant including pumps, filter and measuring meter.
- New reactor installation with associated instruments, blow down pump and chilled water circulation pumps.
- New stripping column with associated instruments, heat exchangers, pumps and filters.
- Two numbers of Pneumatic conveying blowers to increase conveying capacity.
- New Hot DM Water storage tank will be installed near battery limit.
- Replacement of VCM condenser with higher capacity.
- Installation of low cost initiator technology which includes new storage tanks and preparation vessel for pigment and catalyst preparation at pigment building.

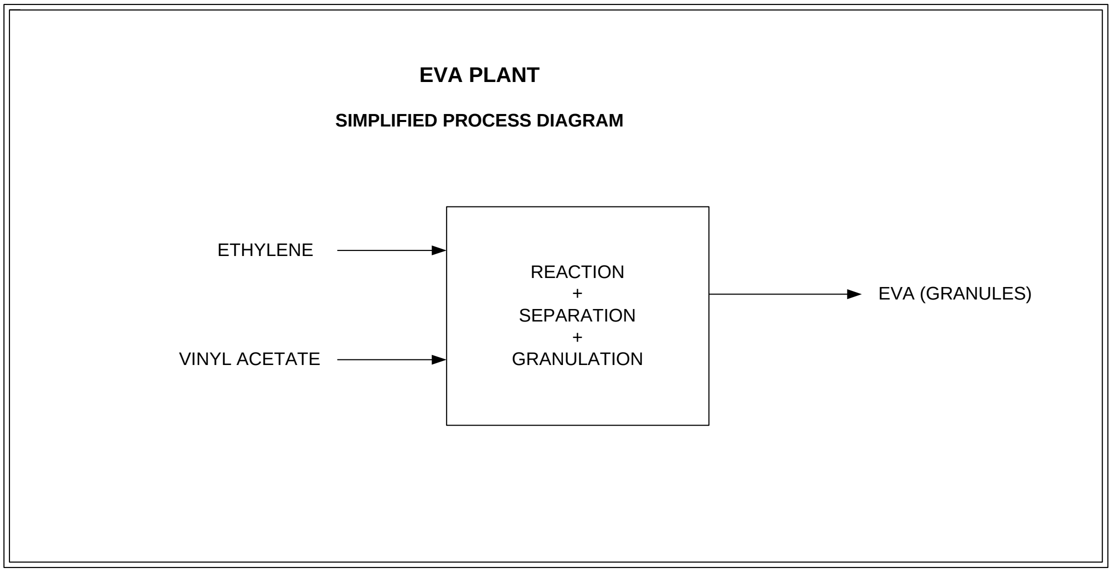


PVC process Flow

Ethylene Vinyl Acetate (EVA)

The Process

Ethylene, the main raw material is copolymerized with Vinyl Acetate to produce Ethylene Vinyl Acetate (EVA). Ethylene feed gas is compressed in multiple stages to attain a pressure upto1500 bar. Vinyl Acetate, which is injected into the ethylene gas stream, reacts in presence of catalyst to yield the polymer. The molten polymer from the reactor goes for extrusion and the unreacted gas is recycled back. EVA pellets are formed in the BDP (Blending, Deodorizing, Packaging) Section. Three different grades of EVA with varying Vinyl Acetate content and Melt Flow Index (MFI) are made.



EVA Process Flow

Proposed Modification:

It is proposed to have additional chillers at EVA plant to maximize the throughput. The design chilled water to the plant is 6°C to get maximum throughput of EVA production.

High Density Poly Ethylene Unit (HDPE)

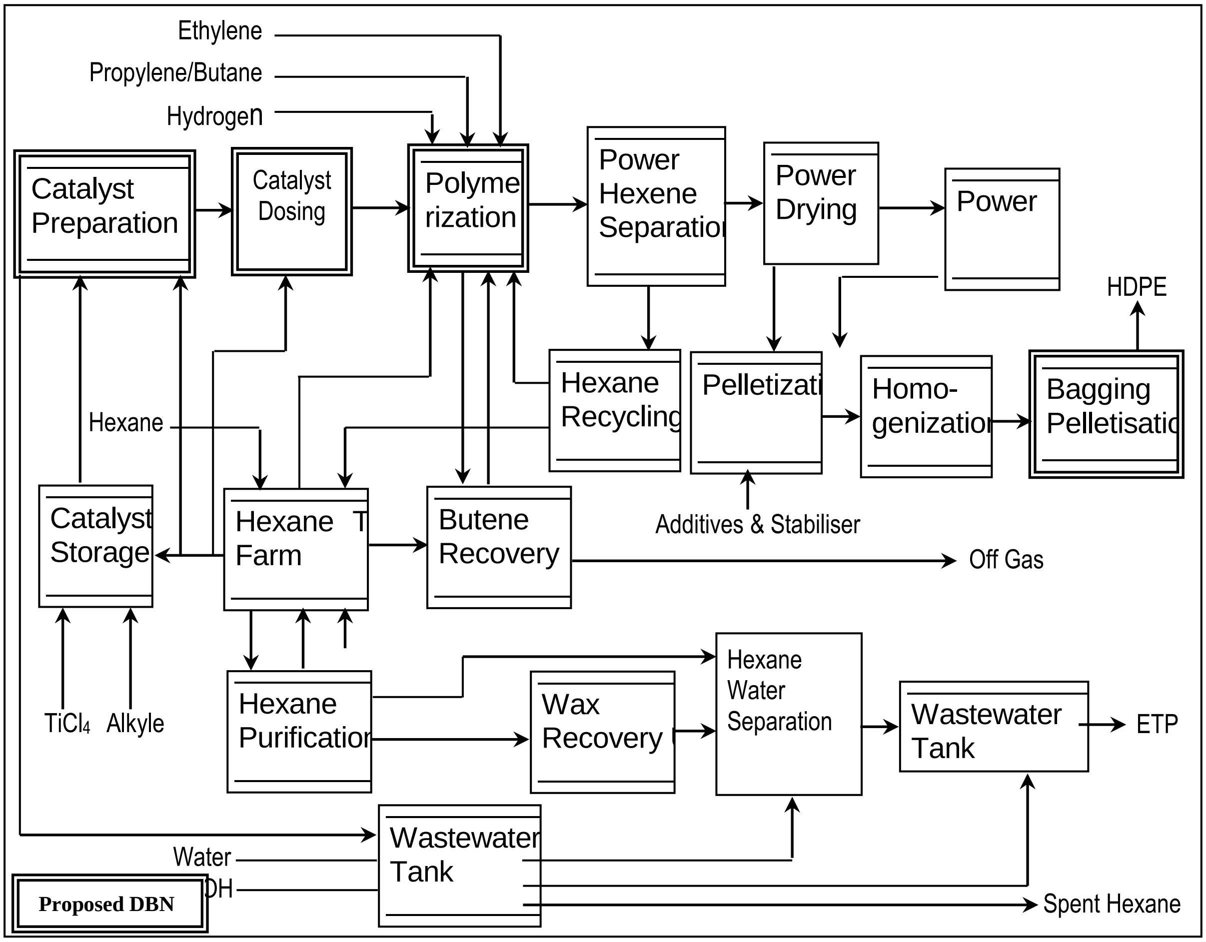
The Process

High Density Polyethylene is produced by polymerization reaction of Ethylene, using Butene as a co-monomer in presence of catalyst. Hexane is used as the media.

Ethylene, H2, Hexane and Comonomer (Butene) are fed to the reactor. The reaction takes place in the slurry state under mild condition. Reaction is exothermic in nature. Removal of heat of Polymerization is done by circulating cooling water. The slurry discharged from polymerization section is fed directly to centrifuge to separate into polymer & solvent. The wet cake conveyed to dryer and is dried into dry powder and then powder is pneumatically transferred by Nitrogen to a receiving hopper of pelletizing section. Mother liquor discharged from the centrifuge is separated into two streams. One is directly recycled to polymerization section as solvent and the other is transferred to Hexane recovery section to be separated into low polymer & solvent. Dry powder & stabilizers are weighted and fed to the Pelletizer in a predetermined ratio. Powder is transferred from the receiving hopper to the Pelletizer by gravity force under N2 atmosphere. Pellets, thus, obtained are transferred to storage & homogenizing 'silos'. All pellets are transferred pneumatically to the packing facilities for bagging.

$$(CH2 = CH2 + CH2 = CH2)n \xrightarrow[\triangle H = 954\ Kcal/kg]{} (- CH2 – CH2 – CH2 – CH2 –)n$$

HDPE pellets are transferred to bagging feeding 'silos'. The bagging machines will weigh the product, fill the bags and discharge the bags to conveyor/warehouse.



HDPE Process Flow

Proposed Modification:

It is proposed to change type of catalyst used for the polymerization to take place. After the polymerization takes place a higher capacity slurry circulation pump is proposed to be installed. At the process end when the HDPE pellets are being pelletized, a modification in Extruder pump is also proposed. Also, a new jumbo bagging machine needs to be added to cater special customer requirement.

The followings section describes in brief the process of the new plants of CPVC, VCM, PVC & Ethane storage tank planned along with the DBN proposal.

Chlorinated Polyvinyl Chloride (CPVC)

In this proposed project a new plant is proposed for CPVC within the DMD petrochemical plant. The CPVC plant will be of 70,000 MTPA capacity comprising of in two lines. Accordingly, the auxiliary facilities of 70,000 MTPA capacity like Product/ Feed Silos, Neutralization System, Chemical preparation facilities, Chlorine scrubber and Chlorine evaporator etc. will be established. The feed stock for CPVC plant is PVC which will be sourced from existing PVC Plant at the rate of 54 KTA through a pneumatic conveying line. CPVC plant shall also consist of a compounding facility of 24 KTA capacity for producing fitting grade CPVC. All other process stream (Chlorine, caustic etc) and necessary utilities (DM Water, Cooling water, Service water, LP Steam, Instrument/ plant air etc) will be sourced from existing facilities within DMD petrochemical plant. Necessary piping tie-ins will be taken from existing facilities and routed to CPVC plant for this purpose. Calcium hydroxide $Ca(OH)_2$ requirement shall be purchased from the market in powder form. In this proposed project of CPVC minor construction is also planned such as Equipment foundation, Concrete and steel structure for equipment installation, Substation building, Control room building, Concrete /steel Pipe racks, Interconnecting piping, Equipment erection(Mechanical, electrical and Instrumentation), minor trenching for Electrical and Instrumentation cable laying etc.

The Process:

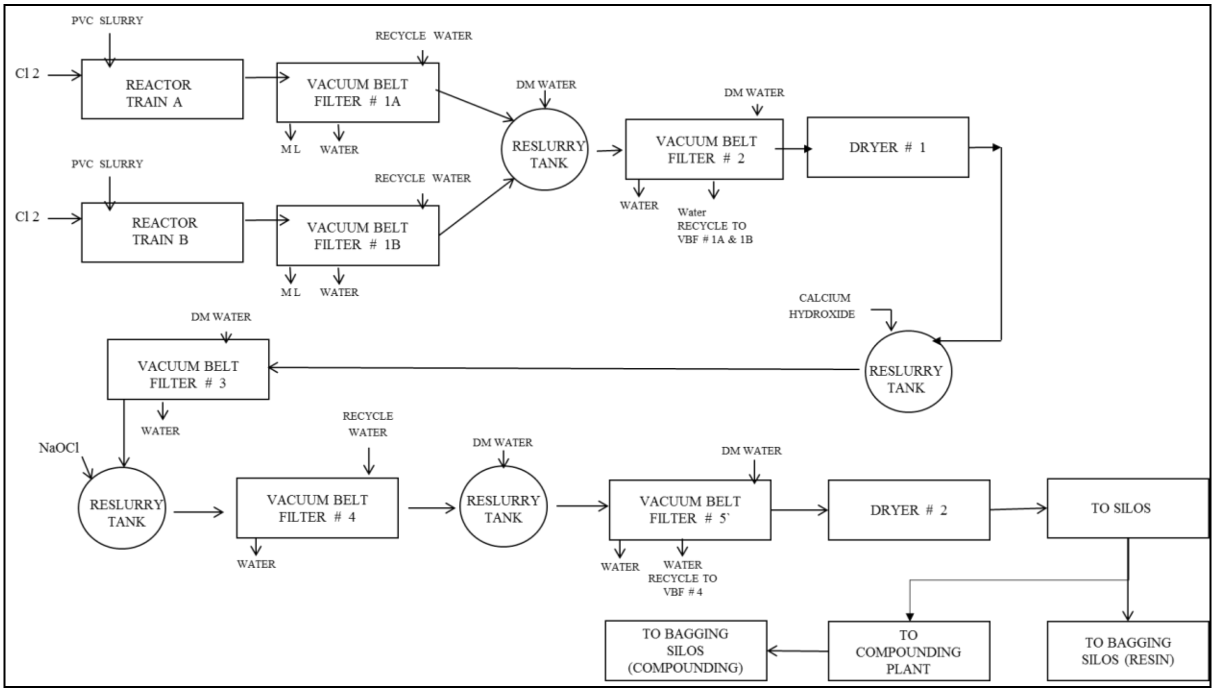
CPVC plant and its compounding unit shall be designed based on RIL's in-house technology. PVC powder (high porosity) shall be received in CPVC plant from existing PVC plant as feedstock. In CPVC plant, PVC slurry shall be prepared by mixing PVC powder and DM water in slurry preparation unit. Subsequently, PVC powder slurry shall be chlorinated in reactors (10nos. x 25m3). Typically the reaction is initiated by application of thermal LED energy to the PVC slurry. Chlorine gas decomposes into free radical which reacts with PVC by replacing hydrogen. Hydrogen reacts with chlorine and forms HCl as byproduct. With the result of reaction, CPVC is produced having 67 $\pm$ 0.3 wt % chlorine content. Subsequently CPVC slurry is fed to vacuum belt filter for removal of HCL byproduct and further washed with DM water in series of vacuum belt filters and neutralized and dried in drying unit in two stages before sending dry CPVC resin to check silos for quality assurance. Dried CPVC resin is then transferred to the product silos through pneumatic conveying system. From the product silos CPVC is transferred to warehouse for bagging and also to compounding unit for converting in to value added product.

Major Sections of CPVC Plant

The CPVC Plant configuration shall comprise of following sections:

- PVC Feed Slurry Preparation
- CPVC Reaction section
- Slurry Washing and Filtering
- Vacuum Drying section
- Final Product Drying
- CPVC Compounding unit
- Neutralizing section
- Chlorine evaporation unit
- Chlorine Scrubbing unit

- Product storage and Bagging
- PVC intermediate storage and pneumatic conveying system
- Chemical preparation area



CPVC Process Flow

VCM

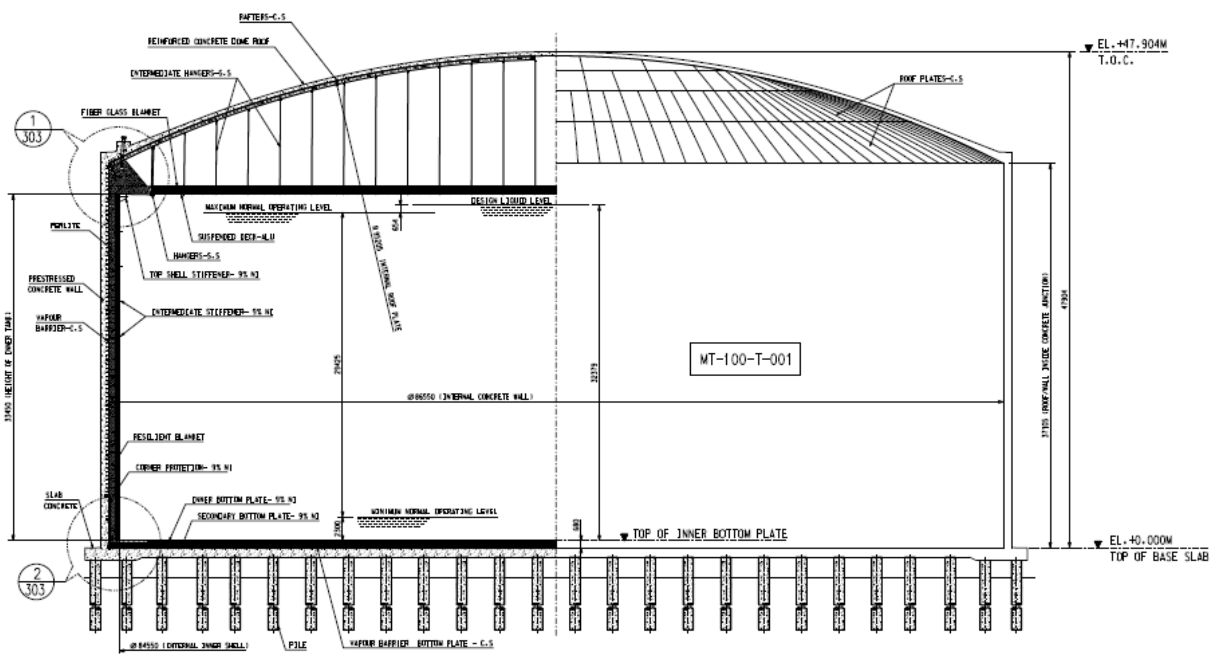
It is proposed to set-up a new VCM plant within the DMD petrochemical plant with a capacity of 12, 00,000 MTPA. The raw material for production of VCM such as Ethylene would be mostly available in-house, it is also planned to import Ethylene and EDC. The VCM production process is similar to existing VCM plant within DMD except EDC manufacturing facility which is not envisaged in new plant. The brief description of the process is given earlier in this chapter.

PVC

It is proposed to set-up a new PVC plant within the DMD petrochemical plant with a capacity of 12,00,000 MTPA. The main raw material for production of PVC is VCM. VCM produced in proposed 12,00,000 MTPA VCM plant will be utilized for PVC production. The PVC production process is the same as in the existing PVC plant within DMD. The brief description of the process is given earlier in this chapter.

Ethane Storage

A cryogenic Ethane storage tank is proposed within the existing DMD petrochemical plant. The ethane as feedstock for cracker will be received at the jetty of GCPTCL and stored in the proposed tank of 1 x 90000MT capacity. The ethane shall also be pumped to other RIL manufacturing division located at HMD & NMD as well. The ethane will be pumped to storage tank in cryogenic pipeline & ~ 2 km length of this pipeline lies within the DMD boundary and is part of this proposed project. The other supporting facilities for the storage tank proposed are flare stack of ~ 30m height, control room, Boil off Gas (BOG) Compressor, booster pump, metering skid etc, is proposed to be set-up after detailed engineering.



Schematic of Ethane Storage Tank

The tank is a dome type structure with ~ 84.5 m inner tank diameter and ~33 m inner tank height i.e. from the top of the base slab. ~536 piles of 1 m diameter & 36-40 m depth are required to be cast in site on which the storage tank is proposed to be constructed. The safety features envisaged for this storage tank are as follows;

- Tank is designed based on API 620 & 625 standards.
- The outer wall is made up of 800mm pre-stressed concrete, the bottom slab of the tank is made of 900-1200 mm thick pre-stressed concrete.
- A metal inner tank which hold the ethane within this concrete structure is of 9% Nickel
- Outer wall is designed for a blast pressure of 2.5 PSI
- BOG compressors are provided to avoid over pressuring of the tank

- In case of over pressure built-up PSVs are provided which are in turn connected to the ~30 m flare stack
- In case of spillage from the tank, containment facility in the form of impoundment basin is provided with foam system to avoid fire
- Vapour barrier of 5 mm carbon steel plates are in place to avoid moisture, these plates are placed in between the concrete walls and the metal tank
- Fiber glass blanketing and perlite insulation is proposed in the 1 m gap in-between the concrete walls & the metal tank to maintain the temperature of ethane

Utilities

The DMD petrochemical plant has an integrated utilities system which includes plants for the treatment and distribution of raw water steam/condensate, cooling water, DM water, fire water, compressed air, nitrogen and oxygen, hydrogen, fuel gas and power plant. Whereas offsite facilities includes the storage, receipts & transfer, loading and unloading of chemicals, products and by-products. The areas covered under utilities are listed below, the proposed DBN as well as the new CPVC plant shall utilize the existing utilities during its operations and no expansion is proposed.

- Air Separation Unit
- Compressed air system
- DM water plant
- Raw water
- Cooling towers
- Captive Power Plant
- Fire water system
- Tank farm
- Effluent Treatment Plant (ETP)

However, the new VCM & PVC plant, the following new facilities are envisaged. Raw material for VCM such as EDC & Ethylene shall be stored in the existing tanks farm.

- Cooling Tower plant
- Air Separation unit
- Compressed air system

Environmental Aspects

The proposed expansion & debottlenecking at DMD shall not have any significant adverse impact on the environment setting of the region. However, this section provides the details of the environment considerations of the proposed project.

Air Emissions

The expected air emissions from a petrochemical plant are PM, SO_2, NOx and hydrocarbons (HCs/VOCs). In the proposed project, natural gas is used as fuel for combustion which is a clean fuel. Hence, emission of SO_2 will be negligible due to burning of fuel. NOx will be generated from the GC furnaces. Such emissions will be controlled and will be within stipulated standards. However, adequate measures shall be place to mitigating impacts on ambient air quality during the project operations. PM emission is envisaged from the process plants. Although, PM emission are very negligible, adequate measures such as bag filters are in place to control such emissions. Fugitive emissions in the form of VOCs is envisaged during the proposed project. To control such emissions, adequate measures are in place such as provision of internal floating roof tanks with flexible double seal for storage tanks, mechanical seals in pumps etc.

In the proposed project an additional furnace shall be installed in the GC and the new VCM plant. The furnace at GC will be equipped with a stack of ~ 38 m & the furnace at new VCM plant will be equipped with a stack of ~62 m height from the ground level to disperse the emissions adequately. At the newly proposed CPVC plant, Chlorine scrubbing system will be installed inside CPVC battery limit to meet statutory norms for gaseous emission and to prevent accidental release of chlorine into atmosphere. Further, at the new VCM plant, an incinerator is proposed to burn out the heavy hydrocarbon generated from EDC cracking process. Adequate control system shall be in place such as HCL scrubbing to keep air emissions within statutory limits. In the proposed project, smokeless flare proposed to burnout any accidental release of gaseous emission from the ethane storage tank as well as the VCM/PVC plant.

Noise

The major source of noise generation shall be from process plants, compressors, pumps, etc. In the proposed project there is no anticipated increase in noise level. However, adequate precaution will be in place to maintain noise level within prescribed limits.

Water Consumption and Effluent Generation

The proposed project requires water for operation of its processes, process cooling, utilities cooling, domestic consumption, fire water make up and greenbelt development etc. No adverse environmental impact is envisaged due to withdrawal of water by DMD. The existing water requirements at DMD is ~1, 15,420 m^3/d. In the proposed project, an incremental water quantity of ~ 61,484 m^3/d envisaged taking the total water requirement at DMD to ~ 1,76,903 m^3/d. This total water requirement is met by Vadodara Irrigation Division, & GIDC, Govt. of Gujarat, which has sanctioned ~1,00,012 m^3/d & 36, 368 m3/d of water to DMD, respectively. In total, the water quantity sanctioned to DMD is 1, 36,380 m3/d. The sanctioned letter for water is given at **Annexure 4**. Water is withdrawn from an intake well in Narmada river at Angareshwar village and pumped ~67 km through 48` pipeline and from Jolva village which is at a distance of ~ 15 KM. RIL- DMD is in the process of applying for the allocation of additional ~40, 600 m3/d water requirement with Irrigation Department, Government of Gujarat. The water management plan at DMD is being implemented which includes water conservation measures such as to reduce the net raw water requirement by way of recycle/reuse of treated wastewater to the maximum possible extent wherever it is feasible.

In the proposed DBN activity the effluent generated would marginally increase by ~510 m3/d, this effluent that will be generated is from the CA plant and PVC plant. The new CPVC plant, will generate ~ 6000 m3/d of effluent, the new PVC plant will generate ~ 9600 m3/d. The total effluent that will be generated from this proposed project is ~ 16,110 m3/d and will be treated at the existing ETP. The existing ETP of ~32400 m3/d is adequate to treat additional stream of wastewater. The exact quantity and quality of the wastewater shall be quantified and characterized during the detailed engineering stage and the same shall be considered in the environment impact study for the proposed project. The treated effluent will be disposed though the existing marine out fall with a recommended disposal quantity of 40,000 m^3/d, recommended by NIO, located at a distance of 6.5 km from DMD petrochemical plant, the marine out fall is located at 21º 38` 55.778``N;  72º 30` 52.908``E in Gulf of Khambhat at 15 m below sea level.

Effluent Treatment Plant (ETP)

A brief on the ETP is given below;

The wastewater generated from the proposed project will be subjected to primary treatment, secondary treatment (anaerobic and aerobic) and Tertiary treatment coupled with recycle facility. This will be supplemented by sludge handling system. Primary treatment facility will consist of TPI (Tilted Plate Interceptor Pit) for the removal of free oil, Equalization Tank, pH adjustment Tank for the pH correction, flocculator followed by the DAF (Dissolved Air Floatation) for the removal of emulsified oil.

In the secondary treatment (Anaerobic), consists of holding, conditioning Tank, anaerobic digester, and level control structure & gas holder. In UASB conditioning tank, addition of urea & phosphoric acid, NaOH, HCl, and micronutrients will be done for providing optimal growth conditions for the anaerobic organisms as required. The neutralized & conditioned effluent from UASB Conditioning tank is then fed to UASB reactors for treatment under anaerobic conditions for the reduction of compounds contributing to COD / BOD. The biogas generated from the anaerobic reactor will be recovered and collected in gasholder. The anaerobically treated effluent is routed to secondary treatment (aerobic) & tertiary treatment prior to final discharge. The biogas from the gas holders will be compressed and sent to the process plant for use as fuel. The secondary treatment (aerobic) facility consists lamella clarifier, MBR, aeration tank and MBR tank. The anaerobically treated effluents will then be mixed in equalization tank of the secondary section of ETP. The composite stream from equalization tank is treated in biological treatment process.

The tertiary treatment facility will consists of collection sump, chlorination, pressure sand filters, activated carbon filters, ultra filtration, reverse osmosis and final recycled water holding tank. The treated effluent with addition of cooling tower blow down stream and DM effluent will be subjected to tertiary treatment as mentioned above and reused mainly as makeup water for cooling towers within and reverse osmosis reject water diverted to the guard pond for final discharge. The ETP schematic is given ay **Annexure -5**.

At the newly proposed CPVC plant, a primary effluent treatment facility is envisaged within the battery limits of CPVC. Primary effluent treatment facility shall be comprise of acid and Hypo neutralization facility. After the primary treatment within CPVC battery limit the effluent will be sent to effluent treatment plant as mentioned above for further treatment for reuse & disposal through the existing marine outfall. The major equipment system will be installed within CPVC battery limit for primary effluent treatment are Acidic Effluent Neutralization System, Interceptor

Pit System, Dryer Scrubbing system. A primary treatment facility is envisaged at VCM & PVC plant to remove free oil through a TPI facility and an interceptor pit to remove PVC solids, the details will be provided in the EIA study after detailed engineering.

Hazardous / Non Hazardous Waste Management

The major sources of solid wastes due to proposed project will consist of oily sludge, used oil, molecular sieve, biological sludge, canteen/office wastes, metal scraps, batteries, surplus drums, etc. Present practice of solid/hazardous wastes management as per Hazardous Wastes Management and Handling Rules 2003 amended in 2008 will be extended to the proposed project as well. A secured landfill facility (SLF) at DMD will cater to the disposal of hazardous waste & non-hazardous waste, waste like spent catalyst will be sold to authorized/SPCB approved venders. DMD is a member of Bharuch Enviro Infrastructure Limited (BEIL), which has common hazardous waste disposal facility located at Ankaleshwar. The quantification of Hazardous and Non-Hazardous waste from the proposed project shall be carried out during the EIA studies after detailed engineering.

Green Belt

Development of green belt with carefully selected plant species is of prime importance due to their capability to reduce noise and air pollution impacts by attenuation/assimilation and also for providing food & habitat for local fauna. DMD has developed greenbelt in ~ 231 ha of its land within its premises. The existing green belt will be strengthen by monitoring the survival rate of the planted trees and identifying the more tolerant species for replacement, if needed.

4. **Project Implementation**

Execution Strategy

Execution of the project includes engineering, procurement, construction, installation and start-up the facilities and it will follow the disciplined and orderly project management approach. Established Project management processes and procedures of RIL shall be adopted to complete the project safely within approved Budget, Schedule and Quality.

The Basic engineering package shall be provided by Reliance Project Management Group (RPMG) in consultation with Reliance R&D Department. Detailed Engineering for this project shall be executed by Detail Engineering Consultant i.e. Mumbai Engineering Center (MEC). Detail engineering activities includes development of overall engineering deliverables for all disciplines.

Procurement shall be done with the help of Procurement and Contracts department. Engineering deliverables for procurement such as SOQ for construction contracts, MRs for all tagged equipment and PR for all bulk items shall be developed by MEC.

Construction of above ground structures such as equipment foundations, control building for the proposed CPVC, VCM, PVC & ethane storage tank project shall be executed under the responsibility of site construction department by appointing various Contractors. The construction contractors will include all disciplines i.e. Civil, structural, mechanical, piping, electrical and instrumentation. Vendor services shall be taken for specialized equipment during construction and commissioning phase.

Commissioning and Start-up of the plant shall be joint responsibility of R&D, RTG Projects and DMD Site operations. After successful start-up and handover of facilities, Maintenance and Operation of the facility will be performed by the DMD Operations with routine inspections and surveillance throughout the design basis life cycle.

Project Schedule

Overall completion schedule envisaged for this project is 27 months (+2 months grace period). Following are the major activities which will be scheduled based on logical interdependencies in order to complete this project as per schedule:-

Engineering:

- Basic Engineering design package (Process description, PFD, P&ID, PDS etc.)
- Detail Engineering of the project (P&ID, HAZOP, MDS, IPDS, 3D model, MRs, SOQ, MTO, Layouts, SLD, Loop diagrams etc)

Procurement:

- Long lead items (Compressors, Booster Pumps , In tank Pumps)
- Other Tag items i.e. Heater, vessels, Electrical Switchgears, Instruments, vaporizer, Control Valves
- Bulk materials (piping, cables, trays, Instrument panels , Electrical Panel, valves etc)
- Construction Contracts (Earthworks, civil/ structural works, site fabricated equipment, piping, erection works, Pipe rack etc)

Construction:
Construction is envisaged for the new plants such as CPVC, VCM, PVC & ethane storage tank, the following are the construction operation planned;

- Soil investigation, survey, grading
- Civil works including
  - Equipment foundations for furnace, oxychlorination reactors, compressors, PVC reactors, dryer, silos , pipe & cable tray racks, columns, control room building & substation, warehouse etc
- Structural fabrication and erection of equipment
- Fabrication and installation of process and utilities piping etc
- Installation of Electrical facilities i.e. switchgears, cabling, motors, etc
- Installation of Instrumentation facilities i.e. field instruments, DCS/ ESD system, marshalling cabinets, field/ panel cabling etc

Project Management
An experienced and well-equipped project management team shall be deployed to execute, monitor and control the project throughout the engineering, procurement phases till start-up. Major activities in project management includes the following:-

- Interface with various internal and external stakeholders supporting the project
- Ensuring compliance with all regulatory requirements
- Coordinating the development of “Basic Engineering design package”
- Leading the detailed engineering phase and directing detail engineering consultant (MEC) for development of engineering deliverables to enable procurement and construction activities.
- Timely communication (review meetings, written communication, reports etc) with all stakeholders.
- Enabling procurement activities by providing necessary inputs i.e. MR for long lead items, SOQs for contracts, bids/ tender evaluation, contract award etc.
- Materials Management & Quality Assurance.
- Co-ordination for overall activities at site.
- Project Control activities such as planning, scheduling, monitoring/ controlling, cost control, variance analysis etc.
- Reporting of project progress.
- Co-ordination for commissioning and start-up activities to ensure successful “performance guarantee test run” of the project.
- Handover of plant to Asset owner and Close-out of the project

5. REGIONAL PLANNING BRIEF

The followings sections provide a brief on the regional setting taken from secondary sources. The details shall be provide during the EIA studies.

Planning concept (Type of industries, facilities, transportation etc.)

The proposed DBN activities and expansion plants are located within the existing DMD petrochemical plant located in the industrial area of GIDC. The other industries falling in the vicinity of DMD petrochemical plant are Hindalco Industries Limited-Birla Copper, Petronet LNG, BASF Ltd., GCPTCL, Gujarat Alkalies and Chemicals Limited (GACL), ABG Shipyard, ONGC, etc

Demographic Structure

The salient features of the study area of 10 km radius from the RIL- DMD; as per 2011 census the study area consists of 32877 persons inhabited in the study area of 10 km radial distance from the periphery of the proposed project site. The males and females constitute 57.78% and 42.22% in the study area respectively. The sex ratio in the region is 731 this shows that male population is higher in the region as compared with the female. The literacy level is 85.15%. 17.78% population belong to Scheduled Tribes (ST) and 4.24% Scheduled Castes (SC) indicating that about 22.02% of the population in the study area belongs to socially weaker sections.

Assessment of Infrastructure Demand (Physical and Social)

The infrastructure resource base of the area with reference to education, medical facility, water supply, post and telegraph, transportation and communication facility and power supply etc. are described below:

Education: All the villages have the facility of only primary school while Dahej and Jageshwar villages have secondary schools also. Availability of further educational facilities i.e. higher secondary school is in nearest town Bharuch

Drinking Water: Mode of drinking water supply are mainly through, well and tank. Other source of drinking facilities are Hand pump, river and others sources**.**

Communication and Transportation: Most of the villages have Post Office and telephone connections as communication facility available in the region. Bus services are available almost in all villages and approach routes are either paved road, mud road or foot path

Power Supply: Power supply is available in most of the villages

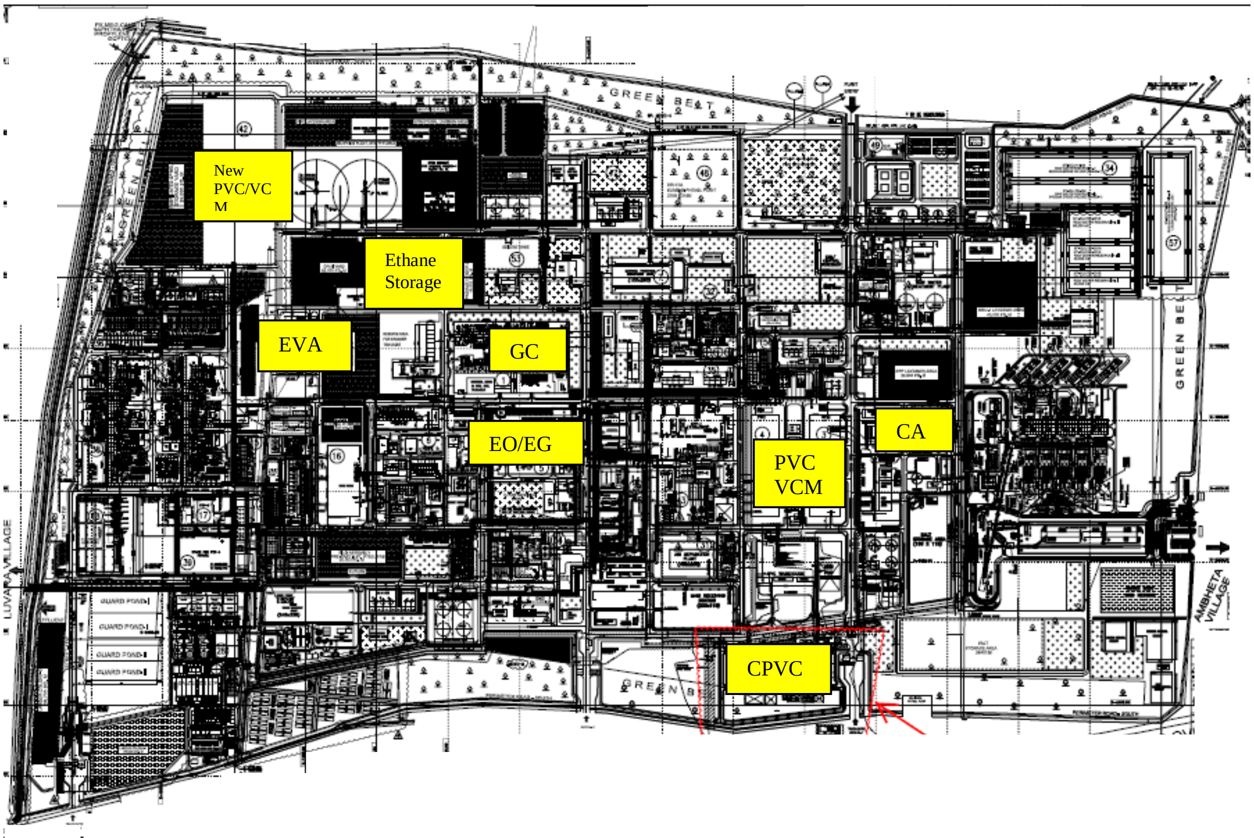
Medical/Primary Health Care: Medical facilities are available in the form of primary health center and primary health sub centers in the region.

Annexure-1

Location of RIL-DMD

Annexure-2

Plot Plant showing the proposed project



Annexure-3

MIDC Industrial Area Notification

Extra No. 209 REGISTERED No. G/GNR/2

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The Gujarat Government Gazette

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Separate paging is given to this Part in order that it may be filed as a Separate Compilation.

PART IV-B

Rules and Orders (Other than those published in Part I, I-A and I-L) made by the Government of Gujarat under the Gujarat Acts.

INDUSTRIES AND MINES DEPARTMENT

Notification

Sachivalaya, Gandhinagar, 9th June, 2009

Gujarat Special Investment Region Act, 2009.

No. GHU-17/SIR/112009/101492/I:—In exercise of the powers conferred by section 3 read with section 4 of the Gujarat Special Investment Region Act, 2009 (Guj. 2 of 2009), the Government of Gujarat hereby,--

(i) Declares the areas specified in column 4 of the villages and the talukas, as specified in column 3 and 2 of the Schedule appended to this notification, of the Bharuch district, as Special Investment Region which shall be known as "the Gujarat Petroleum, Chemicals and Petrochemicals Special Investment Region"; and

(ii) Determines the areas within the boundaries of revenue villages specified in column 4 of the said Schedule to be the geographical area of the said Special Investment Region, measuring 45298.59 Hectares in total.

SCHEDULE

Details of the areas, villages and talukas of the Bharuch district to be known as "The Gujarat Petroleum Chemical & Petrochemical Special Investment Region"

Sr. No.	Taluka	Village	Name of the Revenue Village			
1	2	3	4			
			Extent within PCPIR	Survey No.	Land Mark	Total Area of lands (in Ha.)
1	Vagra	Aragama	Partly	420-423 454-494 496-556 560	Boundary of Vilayat Estate	230.74
2	Vagra	Vorasamni	Partly	373-377 379-382 388-392	Boundary of Vilayat Estate	233.45

IV-B Ex. 209-1 209-1

Sr. No.	Taluka	Village	Name of the Revenue Village			
1	2	3	4			
			Extent within PCPIR	Survey No.	Land Mark	Total Area of lands (in Ha.)
				403-404 408-499 500-599 600-661 820-833		
3	Vagra	Vilayat	Completely	All Survey Nos. 1-1239		1674.56
4	Vagra	Bhersam	Completely	All Survey Nos. 1-1014		1435.10
5	Vagra	Sayakha	Completely	All Survey Nos. 1-410		1567.71
6	Vagra	Kothia	Completely	All Survey Nos. 1-233		606.26
7	Vagra	Vahiyal	Partly	1-43 48 50-717 721-747	Survey numbers below Railway Line	1778.26
8	Vagra	Pipalia	Partly	1-69 83-320	Survey numbers below Railway Line	424.61
9	Vagra	Pakhajan	Partly	1-3 39-528	Survey numbers below Railway Line	1038.66
10	Vagra	Nadarkha	Partly	1-119 213-248	Survey numbers below Railway Line	306.42
11	Vagra	Sambheti	Partly	1-5 10 25-166	Survey numbers below Railway Line	226.58
12	Vagra	Janiadara	Partly	18-55 300-399 400-427 248-256 262-299	Survey numbers below Railway Line	311.79
13	Vagra	Akhod	Completely	All Survey Nos. 1-233		562.27
14	Vagra	Nandida	Completely	All Survey Nos. 1-604		1222.80
15	Vagra	Sadathala	Completely	All Survey Nos. 1-149		449.76
16	Vagra	Khojbal	Completely	All Survey Nos. 1-427		1222.53
17	Vagra	Bhensali	Completely	All Survey Nos. 1-265		563.47
18	Vagra	Atali	Completely	All Survey Nos. 1-384		1082.73
19	Vagra	Galenda	Completely	All Survey Nos. 1-259		579.18
20	Vagra	Samatpor	Completely	All Survey Nos. 1-138		293.05
21	Vagra	Vav	Partly	All Survey Nos. 1-247	Survey numbers below Railway line	321.34
22	Vagra	Jolva	Completely	All Survey Nos. 1-256		874.81
23	Vagra	Vadadla	Completely	All Survey Nos. 1-297		685.87
24	Vagra	Dahej	Completely	All Survey Nos. 1-994		3670.10
25	Vagra	Lakhigam	Completely	All Survey Nos. 1-775		1061.73
26	Vagra	Luvara	Completely	All Survey Nos. 1-290		895.81

Sr. No.	Taluka	Village	Name of the Revenue Village			
1	2	3	4			
			Extent within PCPIR	Survey No.	Land Mark	Total Area of lands (in Ha.)
27	Vagra	Jageshwar	Completely	All Survey Nos. 1-51		1272.32
28	Vagra	Ambheta	Completely	All Survey Nos. 1-544		3745.21
29	Vagra	Suva	Completely	All Survey Nos. 1-779		1431.58
30	Vagra	Rahiad	Completely	All Survey Nos. 1-951		1441.92
31	Vagra	Koliad	Completely	All Survey Nos. 1-235		3727.68
32	Vagra	Vengani	Completely	All Survey Nos. 1-160		441.87
33	Vagra	Kaladara	Completely	All Survey Nos. 1-443		1739.03
34	Bharuch	Amleshwar	Partly	1-797 850-894 934-966 968 984-987 1002-1006 1009-1062		1971.14
35	Bharuch	Bhuva	Completely	All Survey Nos. 1-315		348.42
36	Bharuch	Eksal	Completely	All Survey Nos.		793.04
37	Bharuch	Kesrol	Completely	All Survey Nos. 1-262		581.11
38	Bharuch	Navetha	Completely	All Survey Nos. 1-180		457.97
39	Bharuch	Manad	Completely	All Survey Nos. 1-239		1061.87
40	Bharuch	Mahegam	Completely	All Survey Nos. 1-157		560.82
41	Bharuch	Bhadbhut	Completely	All Survey Nos. 1-208		909.37
42	Bharuch	Kasva-Samni	Completely	All Survey Nos. 1-256		613.74
43	Bharuch	Vadva	Completely	All Survey Nos. 1-95		380.90
44	Bharuch	Sankhwad	Completely	All Survey Nos. 1-199		501.01
						45298.59

By order and in the name of the Governor of Gujarat,

MAHESHWAR SAHU,
Principal Secretary to Government.

Water Allocation Letter

No. WTR-1087/62/Part-II/ Narmada & Water Resources Department,
Sachivalaya, Gandhinagar,
February 19, 1991.

To
Shri Y.R.Karnad,
General Manager (Planning)
Indian Petrochemicals Corpn. Ltd.,
Vadodara.

Sub: Granting permission to draw 22 mgd. of water from river Narmada from Gandhar Petrochemical Complex as per the Water balance of downstream of Sardar Sarovar Dam.

Dear Sir,

1.0 I am in receipt of your letter no.(i) GMP/F/12.1 dated 13-2-1991 and (ii) Letter of even number dated 12-2-1991 addressed to Secretary(CAD), N.& W.R.D. in response to which, I am directed to stated as under :-

2.1 Observed lean flow in river Narmada based on available past record is 35 m^3/Sec (nearly 1000 cusecs) in the month of May and June.

2.2. The aggregate water requirement as per the demand from different units (as per the available record with this department from Narmada river is as under :-

Name of the unit.	Qty.of water required.	Place of Drawal.
(i) GNFC & Bharuch Municipality.	15 MGD	Angareshwar.
(ii) ONGC at Gandhar	4.4 "	Zanor.
(iii) NTPC, Gandhar.	35 "	Angareshwar
(iv) Expected Demand from GWS & S.B.	7 "	Zanor
	57.4 MGD	

i.e. 115 cusec.

2.3 Thus, there will be sufficient flow of water available on Downstream side of Sardar Sarovar dam site from which, the aggregate water requirement for all the industrial units mentioned in para 2.2 above, including 22 MGD of water required by IPCL, can be easily met with.

3.0 In the above context, Government is now pleased to confirm the availability of 22 MGD of water from Narmada river near village Hirjipur and grant permission to IPCL for lifting the same from Narmada river subject to the following conditions:-

3.1 Any drawal from river Narmada will be subject to payment of water charges as may be fixed by the State Govt. from time to time.

3.2 IPCL shall have to enter into an agreement with GOG,

3.3 Location of the Jack-Well to be installed near Hirjipur, shall not conflict with the intake structures of other beneficiaries.

Yours faithfully,
19/2/91
(P. M. Patel)
Under Secretary to the Govt. of Gujarat,
Narmada & Water Resources Department.

Copy to Secretary(E), Block no.12, 1st floor, for information.

કાર્યપાલક ઇજનેર,
વડોદરા સિંચાઇ વિભાગ,
૭મો માળ, રુમ નં.૭૧૭,
આઇ-બ્લોક, કુબેર ભવન,
વડોદરા. ૩૯૦૦૦૧.
ફોન નં.૦૨૬૫-૨૪૧૫૩૭૬

Fax No.0265-2418639.

Executive Engineer,
Vadodara Irrigation Division,
7th floor, Room No.717,
"I "Block, Kuber Bhavan,
Vadodara. 390001.
E-mail address:
vidvadodara@gmail.com
Phone No.-0265-2415376.

No. VID/AB/IND/REQ.2015-16/RIL-Dahej/ 1255 of 2015.
Date: 26 /03/2015

To,
The Vice President,
Reliance Industries Ltd.
Dahej Manufacturing Division,
"VRAJ" Opp. HDFC Bank,
B/H Chandanbala Tower,
Near Suvidha Shopping Centre,
Paldi,
Dist :Ahmedabad - 380007.

Sub : Water Drawal for the ~~Ref~~-Non-agriculture purpose from Notified River / Reservoir - <u>Requirement for the Year 2015-16</u>.

Ref : 1. Govt. Resolution No. WTR/2005/41/P /Dt. 3.2.2007.
2. T.O. letter No.VID/AB/IND/D.W.REQ.QTY/RIL-V/407 Dt.28/01/2015.
3. Your letter No.RIL/VMD/DMD/ 15/ Dt.20/02/2015.
4. Govt. Letter No. WTR/1087/62/Part-2/P Dt.25/09/2014

With reference to above subject, it is hereby inform you that your company has demanded to reserve 22.00 MGD (0.39 MGD for Drinking & 21.61 MGD for Industrial purpose) water for the year 2015-16 vide letter under reference (3).

The demand for the year 2015-16 is same as per the quantity sanctioned for the previous year i.e. 2014-15.

There is no change in your demand for the year 2015-16. Hence it is accepted as per prevailing Government Rules & 22.00 MGD (0.39 MGD for Drinking & 21.61 MGD for Industrial purpose) Qty. is continued for the year 2015-16. This is for your information and further necessary action please.

Executive Engineer,
Vadodara Irrigation Division,
Vadodara

Copy respectfully submitted to the Superintending Engineer, Vadodara Irrigation Circle, Vadodara, for information please.
Copy fwd. to the Deputy Executive Engineer, Irrigation Sub-Division, Vadodara, for information please.

Reliance
Industries Limited

RIL-DMD/CAD/2013-14/31
September 18, 2013

VIBRANT GUJARAT PROJECT

Executive Engineer
Gujarat Industrial Development Corporation
Bharuch

Kind Attn: Shri Janak Gamit

Sub: Dahej Expansion Plans : 8 MGD Water Demand from GIDC Water Supply Scheme

Dear Sir,

As you are kindly aware, RIL has committed investments to the tune of ***Rs 18,000 Crs*** during ***VGGIS'2011 & 2013*** for putting up new Plants for PTA, PET, PSF & CPP and expanding the capacities of PVC/VCM Plants in **Dahej-I Estate.**

Our Captive Raw Water Supply Scheme ex-Angareshwar is not sufficient to cater to the increased Raw Water Demand upon implementation of the aforesaid projects. Thus, we require additional ***8 MGD*** water (in phased manner) from GIDC's Ongoing Raw Water Scheme, as detailed hereunder :

Phase	Phase-wise Water Demand (MGD)	Required in Month'Year
I	5.50	Jun'2015
II	1.10	Jan'2016
III	1.40	Jan'2017
Total	8.00	

We therefore request you to kindly book our phase-wise water demand of **8 MGD** in ***GIDC Water Supply Scheme*** in **Dahej-I Industrial Estate** and provide us necessary details regarding the scheme, tap-off point, documentation requirements, agreement, etc.

Thanking you in kind anticipation,

Yours faithfully,
For Reliance Industries Limited,

(Jayesh Gajjar)
Vice President- Corporate Affairs

Received post
Date 19/9/13
Despatch. Clerk
EE/GIDC Bharuch

Copy fwcs :
1) VC&MD - GIDC
2) CE - GIDC

Dahej Manufacturing Division
P. O.: Dahej, Taluka : Vagra, District - Bharuch -392 130, Gujarat, India. Phone: +91-02641-282000
Registered Office : 3rd Floor, Maker Chambers IV, 222, Nariman Point. Mumbai – 400 021, India.

GUJARAT INDUSTRIAL DEVELOPMENT CORPORATION

(A Govt. of Gujarat Undertaking)
Office of the Executive Engineer,
1st Floor, Narmada Commercial Complex,
M.G. Road, PanchBatti, Bharuch-392001
Phone: (02642)242432/242442 FAX :(02642)241902

No. GIDC/EE/BRH/Contribution charges/ 2738 Date :- 04\10\2013

To,
Shri Jayesh Gajjar,
Vice President – Corporate Affairs,
Reliance Industries Limited.
At. Po. Dahej, Tal: Vagra. Dist: Bharuch.

Sub: - Contribution Charges towards your water requirement for Dahej PCPIR.
Ref: - RIL/DMD/CAD/2013-14, Sept 18, 2013

Dear Sir,
In context to the letter under, it is to inform you that, demand note for payment of contribution charges on account of water supply ultimate / total demand is hereby issued as shown below for payment on or before 20/10/2013.The payment should be made in the name of Executive Engineer, GIDC, Bharuch through RTGS (IFSC Code No- CBIN0280499 and MICR Code 392016001) or by DD in favor of Executive Engineer, GIDC, Bharuch.,(Branch Name- BROACH, Account No.3218076653, Central Bank of India, Code no- 0499)

DEMAND NOTE

Name of Industries	Plot No.	Ultimate water requirement in MGD as per letter under ref.	Contribution Charges per MGD (In Lacs·)	Payable Amount (In Rs.)
Reliance Industries Limited	1	8.00	1300	1,04,00,00,000/-

Note:-

(i) This deposit is towards the contribution charges which shall be adjusted on actual completion of the project.

(ii) In case of payment is made through RTGS the TDS and other bank charges shall have to be added on above amount.

(iii) Any queries on demand note you are requested to contact (1) Shri C.V. Rajani, Deputy Executive Engineer (W/S) Mo: 9879110098, E-mail:- gidcbharuch@rediffmail.com.

(iv) The payment should be done on or before 20/10/2013. Delayed payment shall attract interest as per the prevailing norms of GIDC as amended from time to time.

The suitable sized express pipe line to obtain water from 366 MG reservoir (under constructed at Plot No. D-2/10) to your plot premises shall have to be laid by you at your own and as per the rules and regulations of the Corporation.

Executive Engineer,
G.I.D.C., Bharuch.

Copy to:-
The Dy. Executive Engineer (W/s), GIDC, Bharuch for information please.
The Divisional Accountant, GIDC, Bharuch for information please

Annexure-5

Effluent Treatment Plant Schematic