<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>DM Water system</td>
<td>560 m³/hr capacity</td>
</tr>
<tr>
<td>6</td>
<td>Raw water system</td>
<td>11 MGD Bore well and associated treatment facilities</td>
</tr>
</tbody>
</table>

**Storage facilities**

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>NHT unit feed tank</td>
<td>Two Nos of 12,000 kL</td>
</tr>
<tr>
<td>3</td>
<td>KHDS unit feed tank</td>
<td>Two Nos of 5,000 kL</td>
</tr>
<tr>
<td>4</td>
<td>MTO product storage</td>
<td>one No of 5,000 kL</td>
</tr>
<tr>
<td>5</td>
<td>LPG Moulded Bullet</td>
<td>6 Bullets of 3500 m³</td>
</tr>
<tr>
<td>6</td>
<td>Propylene Bullet</td>
<td>3 Bullets of 3500 m³</td>
</tr>
</tbody>
</table>

**Flare system**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>New flare system</td>
<td>90&quot; dia, 165 m ht stack and associated facilities</td>
</tr>
<tr>
<td>ETP</td>
<td>385 m³/hr feed</td>
</tr>
</tbody>
</table>

1. Time span of schedules of above phases are considered independent.
2. Tendering cycle time duration is considered as 3 and 4 months for item rate contracts and package contracts respectively. However, tender cycle for enabling works tender, like soil investigation, construction power, construction water site grading etc. is considered as 2 to 3 Months.
3. Ordering cycle of category-II equipment / materials is considered as 3 and 3.5 months for indigenous and global MRs respectively.
4. Provision for air freighting of imported items shall be made depending on schedule requirement.
5. Duration of Max. 2 weeks is considered for documents requiring Client’s comments / approval. Efforts to be made to get the documents approved with-in a week or across the table.
6. Since the expected zero date is not known, monsoon period is not indicated on the schedule bar chart. However, the construction activities shall have the Monsoon period impact (~4 Months/year). Adequate monsoon protection shall be kept in scope of respective contractors.
7. Project execution mode is EPCM. However following packages considered as LSTK Contracts:
   a. Raw Water Treatment Plant
   b. RO-DM Plant
   c. Cooling water system: Cooling Towers
d. ETP

e. New Flare System

8. Power supply has been considered from existing facilities.
9. As mechanical completion of CDU / VDU, PP Unit & LPG treating unit has been planned early, initial utility requirement for pre-commissioning / commissioning may be drawn from existing facilities, if required.
10. All statutory approvals (CEA, PESO, EIA, AAI etc.) for establishment of new facilities have been considered in scope of Client.
11. Clubbing of MRs Covering requirement of various units shall be maximized.
12. Piling work considered under Civil / structural contract.
13. Provision of air freighting for imported items shall be made depend on schedule requirement.
14. Procurement of structural steel, cement, Plate for tanks, cable trays, cable ducts, lighting fixtures etc have been considered under respective contractor.
15. The erection of heavy equipment considered in respective Package contractor / Mechanical contractor scope.
16. Composite Works included to get more competitive bids. Composite works included mechanical, piping, insulation, electrical & instrumentation works.
17. Construction Area for the following shall be arranged by Client:
   - Structure steel storage, fabrication
   - Piping shop fabrication
   - Site fabricated equipment
   - Office Space & Storage to the working agencies.

**LIST OF ENABLING WORK UNDER PHASE-I**

1. Dismantling of abandoned Cooling Tower & its associated facilities
2. Relocation of existing GHC store
3. Relocation of inspection Building, GHC maintenance building.
4. Relocation of training centre.
5. Construction of archive & ES building.
7. Relocation of CGP-1 Mechanical Maintenance building & rebuilding.
9. Relocation of petcoke loading gantry.
10. Shifting of LMW & HMW TTL gantry to Dumad with associated facilities at
Dumad.

11. Dismantling of WO & BO TTL gantry
12. Relocation of petcoke weigh bridge.
15. Dismantling of 10 no of spl product tanks & associated facilities.
17. Dismantling of UDHE store.
18. Dismantling of Marketing Building (behind Gate No 10) & canteen & associated facilities.
Chapter 10
Project Cost Estimate & Financial Analysis
Chapter 10
Project Cost Estimate
10.0 CAPITAL COST ESTIMATE

10.1 INTRODUCTION

Indian Oil Corporation Limited (IOCL) operates one of its largest oil refineries at Koyali (near Vadodara) in Gujarat, Western India. The refinery was commissioned in the year 1965 with a nameplate capacity of 3.0 MMTPA. Over the years, the capacity of the refinery has gradually been increased to 13.7 MMTPA with augmentation of old primary Atmospheric Units (AU-I, AU-II and AU-III) and addition of new primary units viz. Atmospheric Unit-IV in 1978 and AU-V in 1999 as well as augmentation of AU-IV in 2000.

At present, Gujarat Refinery has capacity to process 13.7 MMTPA of crude oil, with crude basket comprising of 55% high sulphur crude (7.6 MMTPA) and 45% low sulphur indigenous crude (6.1 MMTPA). In addition to BS-III/BS-IV fuel products, the refinery also has the capability to produce a wide range of specialty products such as benzene, toluene, MTBE, MTO, Food Grade Hexane & LAB.

In current refinery operations, refinery produces Gasoline and Diesel conforming to BS-III & BS-IV specifications. M/s IOCL is now considering expansion of the refinery, with an objective to increase the processing capacity from current 13.7 MMTPA to 18.0 MMTPA.

M/s EIL had carried out the job of configuration study and had prepared a feasibility report for capacity expansion of Gujarat refinery from 13.7 to 18.0 MMTPA as entrusted by M/s IOCL. The report was issued to IOCL on July 2013. This configuration study however had envisaged production of BS-III/IV auto fuels from the refinery with incremental HSD production complying to BS IV auto fuel specification (no incremental motor spirit production was envisaged). However in view of Auto Fuel Policy 2025 by MOP& NG, M/s IOCL intended to update the study carried out in 2013 with additional facilities required for meeting 100% BS VI auto fuel production. Accordingly another Feasibility Report for capacity expansion of IOCL Gujarat refinery from 13.7 to 18.0 MMTPA has been submitted to IOCL during Aug-2016 by M/s EIL. This report was prepared based on agreed design basis considering a new HCU and SDA as additional processing units (as recommended by FR prepared during July-2013), crude/product prices as provided by IOCL and BS VI product quality for gasoline and diesel. But the IRR arrived for this option was lower than the hurdle values due to current price scenarios and revised base case.

IOCL has now assigned EIL, the job to carry out a revised configuration study and to prepare Feasibility report which includes Project cost estimation, Operating cost and Financial analysis with ± 30% accuracy level.
10.2 SCOPE

Cost estimates have been prepared for the selected case considering following Process units, Utilities & Off-sites and associated facilities

<table>
<thead>
<tr>
<th>PROCESS UNIT</th>
<th>UOM</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDU/VDU</td>
<td>MMTPA</td>
<td>15.0</td>
</tr>
<tr>
<td>SR LPG Treater Unit</td>
<td>MMTPA</td>
<td>0.200</td>
</tr>
<tr>
<td>INDMAX FCC Unit</td>
<td>MMTPA</td>
<td>2.40</td>
</tr>
<tr>
<td>PRU</td>
<td>MMTPA</td>
<td>0.40</td>
</tr>
<tr>
<td>CR LPG TREATMENT UNIT</td>
<td>MMTPA</td>
<td>0.80</td>
</tr>
<tr>
<td>FLUE GAS DESULPHURIZATION UNIT</td>
<td>MMTPA</td>
<td>2.40</td>
</tr>
<tr>
<td>NHT</td>
<td>MMTPA</td>
<td>2.4</td>
</tr>
<tr>
<td>ISOM</td>
<td>MMTPA</td>
<td>0.925</td>
</tr>
<tr>
<td>CCR</td>
<td>MMTPA</td>
<td>1.600</td>
</tr>
<tr>
<td>KHDS Unit</td>
<td>MMTPA</td>
<td>0.85</td>
</tr>
<tr>
<td>Gasoline Desulphurization Unit</td>
<td>MMTPA</td>
<td>0.65</td>
</tr>
<tr>
<td>PPU</td>
<td>MMTPA</td>
<td>0.40</td>
</tr>
<tr>
<td>SRU</td>
<td>TPD</td>
<td>1 X 300</td>
</tr>
<tr>
<td>SWS-I</td>
<td>TPH</td>
<td>330</td>
</tr>
<tr>
<td>ARU</td>
<td>TPH</td>
<td>300</td>
</tr>
<tr>
<td>Existing Prime-G Revamp</td>
<td>KTPA</td>
<td>Revamp of 700 KTPA Unit</td>
</tr>
</tbody>
</table>

| UTILITIES & OFFSITES             |        |          |


10.3 PROJECT COST

Capital cost estimate for the identified scope works for the agreed case works out as under:

Capital cost estimate for the selected case is as under:

<table>
<thead>
<tr>
<th>Case</th>
<th>Cost (Rs Crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH CCR INDMAX + PP</td>
<td>15075.35</td>
</tr>
</tbody>
</table>

Validity of Cost estimate is as of 2nd Quarter 2017 price level. Details of Project cost is enclosed as Annexure.

This Capital cost estimate shall be read along with key assumptions and exclusions listed at Para 10.4 & 10.5.

10.4 KEY ASSUMPTIONS

The basic assumptions made for working out the capital cost estimate are as under:

- Cost estimate is valid as of 2nd Quarter 2017 price level.
- No provision has been made for any future escalation.
- No provision has been made for any exchange rate variation.
- It has been assumed that all Process units and utilities & off-site facilities would be implemented on conventional mode of execution.
- EPCM services cost provision is as a factor basis and is indicative.
- Existing infrastructure facilities are adequate and no cost provision has been made for the same.
- As Constructability plan has not been approved at this Stage, no cost provision has been made towards interlinking, hook ups and hindrances if any.
- Following Exchange rates has been considered (wherever applicable) for cost estimation purpose: 1US$ = INR 67.0, 1EURO = INR 75.0.

10.5 EXCLUSIONS

Following costs have been excluded from the Project cost estimate:

- Forward escalation
- Exchange rate variation
- Cost towards statutory clearances, if any
- Any unusual construction requirements
10.6 COST ESTIMATION METHODOLOGY

Cost estimate is based on cost information available from EIL’s current in-house cost data and Engineering inputs for cost estimation purpose. In-house cost data has been analyzed and adopted for estimation after incorporating specific project conditions. Cost data has been updated to prevailing price level using relevant economic indices.

These Cost estimates are subject to identified scope of work and engineering inputs / technical information, the qualifications, assumptions and exclusions stated herein.

The accuracy of these estimates is targeted at ±30% based on the methodology used and the quality of the information available for cost estimation.

Plant & Machinery

The cost estimate for Process units has been prepared based on analogous reference of similar unit executed by EIL and cost has been adjusted for capacity and updated to the present day price level.

The cost estimate for INDMAX FCC Unit and PRU Unit is based on the cost data provided from M/s IOCL.

Cost provision towards BS VI Prime-G Revamp has been made on Lump sum basis as no details of revamp is available.

Catalyst & Chemicals

Provision for first fill of catalysts required is based on in-house assessment of quantities and in-house cost database.

Cost provision for chemicals has been made on lump-sum basis.

Utilities & Off-sites

The cost estimate made under utilities & off-site facilities are for following systems:

- Raw Water System with Intake Well, Raw Water Reservoir and Raw Water Treatment Plant
- Cooling Water System
- RO DM Plant with CPU
- Compressed Air system & Nitrogen Plant
- Storage Tanks and Mounded Bullets
- Flare system
- Offsite Pumps
The cost estimate has been prepared based on system capacities, in-house engineering information and recent in-house cost data available for similar facilities implemented in other projects.

Cost estimate for firefighting /protection system is based on preliminary MTO provided by engineering department.

The cost estimate for Offsite piping is based on preliminary MTO and in-house database. Cost Estimate for Electrical is based on preliminary MTO and includes the cables and Substation Facilities. Cost provision towards Instrumentation has been made on factor basis. Lump sum cost provision for DCS and blending facilities has been made. Cost provision for Civil and Structural works is made on factor basis. Spares and Construction costs has been made on factor basis.

As Constructability plan has not been approved at this Stage, no cost provision has been made towards interlinking, hook ups and hindrances if any.

Steam Generation

Additional Steam requirement has been envisaged for which cost provision has been made for 2X150 TPH Utility Boiler based on recent in-house cost data.

There is no CPP envisaged under this project. Power import shall be done to cater the Power requirement of the Refinery.

Piling

The Cost estimates for piling works is based on piling quantities (34000 Nos) and in-house cost data.

Effluent Treatment Plant

Cost provision has been made for Effluent Treatment Plant based on Engineering information and in-house cost data.

Indirect Costs, Exchange Rates and Statutory taxes / duties

Indirect Costs and Exchange Rates

The cost estimate is based on following Exchange Rates & Indirect costs:

<table>
<thead>
<tr>
<th>Exchange Rate</th>
<th>1 US$ = Rs. 67.0, 1 EUR = Rs. 75.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean Freight</td>
<td>5.0% of FOB cost of imported equipment</td>
</tr>
<tr>
<td>Port Handling</td>
<td>2.0% of FOB cost of imported equipment</td>
</tr>
<tr>
<td>Inland freight</td>
<td>5.0% of FOB cost of imported equipment and ex-works cost of indigenously sourced equipment</td>
</tr>
<tr>
<td>Insurance</td>
<td>1% of total cost</td>
</tr>
</tbody>
</table>
Provision for ocean freight is for supplies by marine transportation / ships only. No provision has been kept for any special transportation means such as Air freighting or usages of barges.

**Statutory Taxes & Duties**

Provision for statutory taxes & duties has been made as under:

<table>
<thead>
<tr>
<th>Tax Type</th>
<th>Rate/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Duty</td>
<td>26.43% of CIF cost of imported equipment (7.5% Basic Customs Duty + 12.5% CVD + 3% Education Cess and 4% SAD).</td>
</tr>
<tr>
<td>Excise Duty</td>
<td>12.5% of ex-works cost of indigenously sourced equipment.</td>
</tr>
<tr>
<td>Central Sales Tax</td>
<td>2% of ex-works including excise duty for cost of indigenously sourced equipment.</td>
</tr>
<tr>
<td>Service Tax on Engineering</td>
<td>15.0% (15% Service Tax + 0.5% Swachh Bharat + 0.5% Krishi Kalyan Cess)</td>
</tr>
<tr>
<td>Service Tax on Works Contract</td>
<td>6.0% (15.0% of 40%) on Contract Value</td>
</tr>
<tr>
<td>VAT on Works Contracts</td>
<td>8.75% (12.5% of 70%) on Contract Value</td>
</tr>
<tr>
<td>Labour Cess</td>
<td>1% on Contract Value</td>
</tr>
</tbody>
</table>

**Land**

Cost provision has been made for Land as per the input from M/s IOCL.

**Site Development**

Cost provision based on the information from M/s IOCL has been made under this head which includes enabling facilities like dismantling works of various facilities including Tanks and buildings and Piping re-routing facilities, construction of new buildings etc. Cost towards Soil Investigation as provided by M/s IOCL is also included under this head.

Additional cost towards Site Grading, Compound Wall, Drains and RCC pavements has been made based on preliminary MTO and in-house cost data.

**Royalty, Know-How & Basic Engineering**

Provision for Royalty, Know-how, Process Design, Licensor’s expatriate and Basic Engineering has been made based on in-house information. Cost includes provision for withholding tax and service tax.
Project Management, Detailed Engineering, Procurement Services & Construction Supervision (EPCM Services)

A provision in the cost estimate has been kept towards the services of project management, detailed engineering, procurement services, construction supervision and commissioning as per information. This fee is indicative in nature. Service tax on EPCM fees has also been considered.

**COT, SPM & Pipeline**

SPM, COT and Pipeline have not been envisaged.

**Roads & Buildings**

Cost Provision for Roads & Buildings has been made as per the cost provided by M/s IOCL.

Additional Cost for Roads and Buildings such as Control Rooms, Substations etc has been made based on the preliminary MTO provided by In-house Engineering. Buildings cost is based on preliminary area.

**Infrastructure Facilities**

It has been assumed that existing infrastructure facilities shall meet the requirement of the project and no cost provision has been made under this head.

**Construction Site Facilities**

Cost provision for Construction Site Facilities has been made @0.25% of Plant & Machinery for items such as Construction Power, Construction Water and Labor camp etc. M/s IOCL has informed that some amenities shall be available from BS-VI Construction Facilities during J-18 execution.

**General Site Facilities**

Cost provision has been made for items such as Laboratory equipment and Office equipment & furniture based on the cost information by M/s IOCL.

**Township**

Not required.

**Owner's Construction Period Expenses**

Cost provision for Owner's Construction Period Expenses has been made @ 1.5% of Plant & machinery for items such as project management, salaries & wages, feasibility reports, training, legal expenses, office & vehicles hire / rentals/maintenance, stationary, postage, travel etc. during project construction period.
Start-up & Commissioning
A cost provision for start-up & commissioning has been made @ 1.5% of plant & machinery cost.

Contingency
Provision for contingency has been made @ 10% of capital cost excluding interest during construction (I.D.C) and working capital margin. The provision has been kept to take care of inadequacies in estimate basis definitions (including design & execution) and inadequacies in estimating methods and data elements.

Working Capital Margin
Not required.

Interest during construction
Interest during construction period required for the project has been worked out based on following:
Debt - Equity ratio : 1:1
Rate of interest : 9.35%
Construction period : 3.5 years
Equity and Debt to be spent concurrently

Based on the above assumptions and exclusions, Project cost summary is enclosed as Annexure.
10.7 FINANCIAL ANALYSIS

Based on capital cost, operating cost and sales revenue, financial analysis have been carried out for calculating internal rate of return (IRR) with a view to establish profitability of the project. The basis of financial analysis is as under:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction Period</td>
<td>42 months</td>
</tr>
<tr>
<td>2</td>
<td>Project Life</td>
<td>15 years</td>
</tr>
<tr>
<td>3</td>
<td>Debt / Equity Ratio</td>
<td>1 : 1</td>
</tr>
<tr>
<td>4</td>
<td>Expenditure Pattern</td>
<td>Equity concurrent to Debt</td>
</tr>
<tr>
<td>5</td>
<td>Loan Repayment period</td>
<td>After moratorium period in 8 years</td>
</tr>
<tr>
<td>6</td>
<td>Moratorium Period</td>
<td>2 Years</td>
</tr>
<tr>
<td>7</td>
<td>Interest on Long Term Debt</td>
<td>9.35%</td>
</tr>
<tr>
<td>8</td>
<td>Capital Phasing (Total Capital)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Year</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td>2 Year</td>
<td>35.0%</td>
</tr>
<tr>
<td></td>
<td>3 Year</td>
<td>45.0%</td>
</tr>
<tr>
<td></td>
<td>4 Year</td>
<td>10.0%</td>
</tr>
<tr>
<td>9</td>
<td>Capacity Build – up</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1st year</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>2nd year</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td>3rd Year onwards</td>
<td>100%</td>
</tr>
<tr>
<td>10</td>
<td>Corporate Tax Rate</td>
<td>@ 30%+ 12.0% surcharge+ 3% Education cess</td>
</tr>
<tr>
<td>11</td>
<td>MAT</td>
<td>@ 18.5 %+ 12.0% surcharge+ 3% Education cess</td>
</tr>
</tbody>
</table>

Annual operating cost has been computed based on annual quantities on differential basis considering average prices towards crude, utilities and fixed operating cost (Salaries & wages, General Administrative expenses@ 0.5% of plant & machinery, Repair & Maintenance @ 1% of Plant & Machinery and Insurance & taxes @ 0.5% of the capital cost).

M/s IOCL provided Cost reduction to be considered towards repair and maintenance, establishments for operation of single CDU/VDU instead of 4 nos, FPUI, VDU & non operation of HGU .The same has been taken care under Operating Cost.

Annual sales revenue has been worked out based on annual quantities on differential basis considering average prices towards products as provided by Client. Details of annual operating cost and Sales revenue is enclosed as Annexure.

Financial Analysis of project has been worked out as per above details.
Based on above methodology, Capital cost estimate, Operating cost, Sales revenue and financial analysis has been carried out for agreed case i.e. HIGH CCR INDMAX + PP based on the Crude and Product average prices and the results is summarized below:

<table>
<thead>
<tr>
<th>S.No</th>
<th>ITEM</th>
<th>HIGH CCR INDMAX + PP Case-572</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capital Cost</td>
<td>15075 35</td>
</tr>
<tr>
<td>2</td>
<td>Variable Operating Cost</td>
<td>12196 51</td>
</tr>
<tr>
<td>3</td>
<td>Fixed Operating Cost</td>
<td>232 84</td>
</tr>
<tr>
<td>4</td>
<td>Total Operating Cost</td>
<td>12429 34</td>
</tr>
<tr>
<td>5</td>
<td>Sales Revenue</td>
<td>17325 26</td>
</tr>
<tr>
<td>6</td>
<td>IRR on Total Capital</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre-Tax</td>
<td>20.48%</td>
</tr>
<tr>
<td></td>
<td>Post-Tax</td>
<td>16.20%</td>
</tr>
<tr>
<td>7</td>
<td>IRR on Equity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre-Tax</td>
<td>26.50%</td>
</tr>
<tr>
<td></td>
<td>Post-Tax</td>
<td>20.34%</td>
</tr>
</tbody>
</table>

**Enclosures:**

**Annexure-I**

**Capex, Opex, Sales Revenue & Financial Results**

1. Project Cost Summary (1 sheets)
2. Utilities / Off-sites cost summary (1 sheet)
3. Annual Operating cost (1 sheets)
4. Annual Sales Revenue (1 sheets)
5. Cash flow statement (1 sheets)
SECTION 11.0
HEALTH SAFETY & ENVIRONMENT
11.1 HEALTH & SAFETY

In order to ensure identification of any hazards associated with the project, which could adversely affect the health and safety of personnel both within and outside the complex, and the environment, a sound Health, Safety and Environment (HSE) policy is proposed to be adopted during the course of project execution with primary objectives as under.

a) Provide clearly defined safety system goals for the design aspects of the project.
b) Ensure a safe working environment for all plant personnel.
c) Through intrinsic safety in design, eliminate the potential for occurrence of hazardous scenarios that can result in injuries, environmental damage, business interruptions or loss of assets.
d) Minimize the risk and consequences of an accident which cannot be eliminated by intrinsic safety in design.
e) Maintain satisfactory means of escape and evacuation from any conceivable incident.
f) Minimize the potential for pollution of the environment from accidental spills, venting or flaring of hazardous materials.

In order to ensure the above, it is proposed to carry out the following HSE related studies during the engineering stage:

- Hazard identification (HAZID) study
- Hazard and Operability Study (HAZOP)
- Quantitative Risk Assessment (QRA) Study
- Environmental Impact Assessment (EIA)
- Hazardous Area Classification

Other health hazards that are proposed to be studied are as follows:

a) Lighting
b) Noise
c) Thermal Environment

11.2 ENVIRONMENT

Wastes are streams that are not produced for sale or internal consumption. Some of these wastes may be toxic, poisonous, flammable and harmful to the environment. Hence, it is of utmost importance that the wastes generated are disposed off safely. When waste production cannot be avoided, the following design principles shall be adopted to achieve environmental compliance:

a) Minimise the waste generation
b) Safe disposal facilities within development boundary
c) Safe disposal facilities outside the unit.
Wastes generated are of three types:

a) Solid

b) Liquid
   i. Aqueous
   ii. Non-aqueous

c) Gaseous
   i. Point source gaseous emissions
   ii. Fugitive emissions

Adequate care will be taken in process design to minimize the quantity of waste produced. In addition, solid, liquid and gaseous wastes generated from various processes in the refinery will be handled in a manner that minimizes their impact on the environment.

In addition a Plant Safety and Environment Cell consisting of qualified and experienced technical personnel from the relevant fields will be in place to ensure effective operation of all pollution control measures and suggest further improvements where necessary.
SECTION 12.0

CONCLUSION & RECOMMENDATIONS
CONCLUSION & RECOMMENDATIONS

IOCL intends to enhance the crude processing capacity of its Gujarat Refinery from present 13.7 MMTPA to 18.0 MMTPA with the consideration of production of 100% BS VI quality gasoline and diesel products from the refinery. The feasibility study of the expansion project has been carried out for processing of additional 4.3 MMTPA Basrah Lt Crude.

Several configuration were studied with various options of secondary processing and bottom up gradation. Based on preliminary analysis, the option with High CCR INDMAX with polypropylene production was found to be most optimum.

Following new facilities are required to increase the existing refinery capacity from 13.7 to 18.0 MMTPA with the objective to produce BS VI quality products.

- New AVU with LPG/ATF treating Unit
- New INDMAX Unit including PRU and LPG treatment
- New Poly-Propylene Unit
- New MS Block with NHT/ISOM/CCRU
- New Gasoline Desulphurization Unit
- New KHDS Unit
- New Sulphur Recovery Unit along with TGTU
- New Sour Water Stripping Units (Single/Two Stage)
- New Amine Regeneration Unit
- Associated Utility facility and offsite facilities.

The following are the result of financial analysis

- The total Capex estimated with ±30% accuracy Rs. 15075.35 crores.
- IRR on total capital works out to be 16.20%, post tax.
- The present configuration results in high distillate yield and zero fuel oil sales.

The addition of these facilities along with expansion from 13.7 to 18.0 MMTPA results in enhancement of GRM of the refinery. The Capex required for expansion is estimated to be 15075 Cr with +30% accuracy, which gives a very attractive post tax IRR of 16.2% on total capital.

The resulting configuration enhances the refinery capability to produce more diesel and gasoline along with petrochemical production. At the same time long term objectives of zero fuel oil, zero kerosene and minimization of naphtha is achieved. Therefore expansion of refinery form current capacity of 13.7 to 18.0 MMTPA is highly recommended.
ANNEXURE-II
ANNEXURE-III
ANNEXURE-IV