



**मंगलूर रिफाइनरी एण्ड पेट्रोकेमिकल्स लिमिटेड**

**MANGALORE REFINERY & PETROCHEMICALS LTD.**

(ऑयल एण्ड नेचुरल गैस कॉर्पोरेशन लिमिटेड की सहायक कंपनी)

(A Subsidiary of Oil and Natural Gas Corporation Ltd.)



## **EXPRESSION OF INTEREST (EOI)**

**FOR**

**STUDY AND IMPLIMENTATION OF  
DIENE/DIOLEFIN SATURATION REACTOR AT MRPL  
SEZ AROMATIC COMPLEX NHT SECTION OF CCR  
UNIT**

**EOI NO.: MRPL/AR/EOI/2023-2024/01**

**Global Invitation for Expression of Interest (EOI)**



**Invites Expression of interest (EOI)**

**For**

**Study & Implementation of Diene/Di-olefin saturation reactor at MRPL Aromatic complex NHT section of CCR unit**

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## 1. INTRODUCTION:

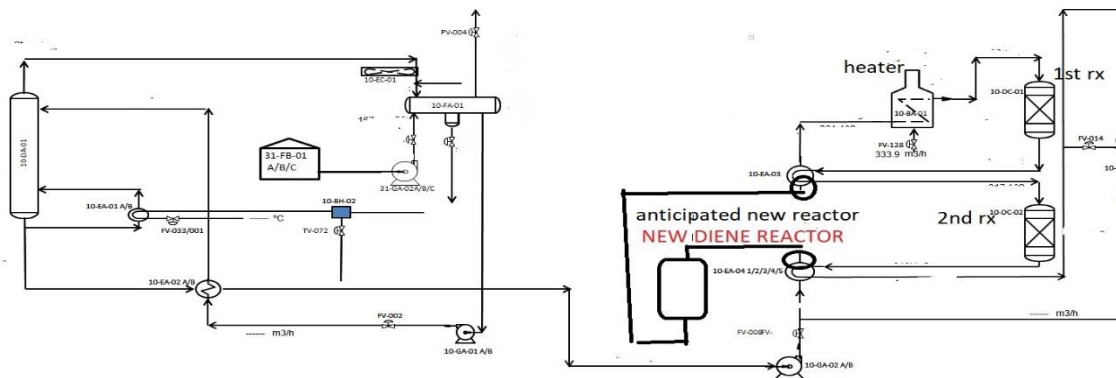
MRPL Aromatic Complex is located in Special Economic Zone (SEZ) area of Mangalore. The primary purpose of this complex is to produce 0.9 MMTPA of para-xylene and 0.3 MMTPA of benzene from naphtha and aromatic feed stocks supplied from refinery.

The purpose of the Naphtha Hydrotreating (NHT) unit is to prepare the feed for the CCR Platforming unit. The feed for the NHT unit is a combination of blends of seven different naphtha streams including FCC Naphtha, coker naphtha and straight run naphtha.

Since the start-up of the unit & coker naphtha feed introduction, the unit has suffered chronic pressure drop build up issue, severe fouling of feed side of cold and hot combined feed heat exchangers, charge heater & reactors for which NHT Unit has undergone several shutdowns. One of the cause for fouling and the pressure drop build is due to gum formation because of polymerization of di-olefins in feed blend.

MRPL Intends to install the Di-olefin (diene) Saturation Reactor which will saturate highly reactive di-olefins and mitigate the fouling and pressure drop issues. MPRL will provide NHT Feed Specification i.e typical blend of Straight Run & cracked with Battery limit conditions (temperature and pressure) for major incoming and outgoing streams. (Relevant NHT section data is given in Annexure-1)

### Typical NHT diagram and new low temperature diene saturation reactor location.



Tentative plan /Procedure for Diene/diolefin saturation Reactor study implementation process is envisaged in below stages

### Stage 1:

1. Pre-qualification of bidders by floating an Expression of Interest, EOI on global basis.
2. Evaluation of Pre-qualification documents submitted by the bidders against the EOI prequalification criteria and bidder qualification for the next stage.

### Stage 2:

1. Bidders meeting the Pre-Qualification criteria in Stage I (after submission of signed NDA /personal NDA with the licensors) shall be eligible to participate in the next stage.
2. Draft detailed scope, detailed technical specifications, required data's for preliminary cost estimation will be shared with qualified vendors from expression of interest for getting the preliminary budgetary quotations.
3. Limited tender with final technical specifications and project schedule will be issued to the qualified (through EOI) bidders.
4. Evaluation of limited tender bids with all Technical requirements will be done and Bid Evaluation Criteria shall be on L1 cost basis.

Further in this document which is Stage 1 Expression of Interest (EOI) outlines the vendor's scope of work in EOI, during the project with other relevant details. Also document provides details with the Prequalification criteria requirement submission with this EOI requirements are provided. Vendor to note that MRPL shall not mediate NDA agreement and is completely vendor's responsibility. Based on the details provided in the EOI and MRPL intention of installing Di-olefin saturation reactor in NHT section which will saturate highly reactive di-olefins and mitigate the fouling and pressure drop issues vendor to approach Licensors and get NDA clearance for all relevant data requirements for study, implementation and guarantees. Post NDA clearance and M/s UOP (Licensors concurrence) only Licensor allowed data/ other information will be shared with potential bidder for study and implementation.

## 2. **Brief Vendors Scope of Work:**

1. Carry out the sizing study of Diolefin saturation reactor required for diene saturation and at the outlet diene should be reaching desired value of <0.5.
2. After NDA agreement Vendors can conduct a "Study" to determine hydraulics requirements for the new reactor in the existing NHT loop high pressure reactor circuit, review of design pressure of high pressure equipment and adequacy of major equipment like recycle gas compressor, charge pump etc.
3. Design, licensing of Diene saturation reactor , preparing Basic Engineering Design Package (BEDP) containing design basis, PFD, Hydraulic evaluation of the NHT reactor circuit, process equipment data sheets, PIDs, instrument data sheets, as-built Equipment datasheet, De-pressuring system check , review of existing

Interlocks and Cause and Effect line schedule, flare load & and catalyst/chemical requirements. Engineering and Construction management if any of the same.

4. Vendors will also have to perform yield estimate for the Diolefin saturation reactor with the Design Feed Cases to evaluate the impact on major equipment based on the available catalyst with the vendor and Estimated product properties, catalyst quantity and reactor loading, and estimated cycle length will be reported in the yield estimates; Vendors can study Design pressure of existing high-pressure equipment will be evaluated as a part of the study if required modifications/replacement of existing equipment will be recommended wherever appropriate.
5. Vendor will have to provide the following Guarantees
  - a) Vendor to guarantee the below @ fresh feed rate of 175 m<sup>3</sup>/hr after addition of Di-olefin Saturation Reactor
  - b) Diolefin saturation Reactor outlet diene value < 0.5
  - c) Meet 48-months catalyst cycle length in DI-OLEFIN SATUATION REACTOR.
  - d) Pressure drop Guarantee: Vendors can provide estimated pressure drop SOR /EOR for the DI-OLEFIN SATUATION REACTOR catalyst and provide guarantee on the same.
  - e) Turn down ratio Guarantee: Unit to be operable and DI-OLEFIN SATUATION REACTOR Reactor outlet diene to be <0.5 @ turndown ratio of 80m<sup>3</sup>/hr.
6. The key deliverables once the tender is placed on the vendor as typical part of the work includes the following:
  - a) Executive summary of the results of the Study;
  - b) Statement of the basis, objectives, and scope of the Study;
  - c) Discussion of results of the Study, including a description of design case considered and a review of any bottlenecks and recommended modifications;
  - d) Summary of operating conditions, yields, and product specifications; Release of PFDs, H&WB (Heat and Weight Balance), and Draft Study Report with preliminary cost estimation.
  - e) Flagged Process Flow Diagrams showing schematic flow and control;
  - f) A list new major equipment required for DI-OLEFIN SATUATION REACTOR project.
  - g) Vendor will explain why new/modified equipment is recommended, and provide relevant data including approximate equipment sizes as a part of Preliminary Equipment Data Sheets (PEDS). Vendor will also provide a description of any suggested equipment modifications;
  - h) Vendor also to provide Mark-up's on "As Built Plot Plan" for new equipment addition after studying the existing plot plan of the unit. The new markup plot plan should meet statutory compliance like OISD
  - i) Vendor will provide the preliminary utility summary for the di-olefin Reactor Section. Vendor to also study the evaluation of instruments, piping, and relief valves to be included and need to change in the existing loop due to addition of new reactor, with additional DP. Vendor to declare the design plug DP of the new

DI-OLEFIN SATUATION REACTOR and changes in loop relief valve system (if any) to accommodate the new DI-OLEFIN SATUATION REACTOR.

- j) Technical assistance and on-site supervision of vendor representative during commissioning loading of the catalyst, start-up and PGTR will be required.
- k) Technical assistance and troubleshooting of di-olefin catalyst issue during the entire tenure of guaranteed life. Operating manual if any for the reactor operations to be submitted.
- l) Vendor to utilize the existing DMDS facility (for startup sulfiding) and RGC/Makeup gas compressor (for Hydrogen supply to DI-OLEFIN SATUATION REACTOR) by taking suitable tapping form the existing setup.
- m) Vendor need to utilize the existing Cold/HOT CFE/Heater combination to achieve the temperature in the new DI-OLEFIN SATUATION REACTOR with studying the optimum heat integration of the existing system. No new Heat Exchanger introduction is envisaged.
- n) MRPL AC keep the right to use any vendor catalyst in the downstream existing NHT reactor.

## **Annexure 1:**

### **Brief description of the NHT unit with relevant technical details.**

The NHT unit includes an oxygen stripper for the combined naphtha feeds, reactor section and stripper sections. The reactor section has two reactors with combined feed exchange between the reactors. This unit also includes an amine absorber on the stripper net gas to remove the H<sub>2</sub>S from the net gas.

The FCC naphtha, coker naphtha and straight run naphtha feeds are combined in internal floating roof tanks with nitrogen blanketing and are treated in an Oxygen Stripper. Oxygen Stripper is needed to break down peroxides that may be present in the feed which can result in gum formation and ultimately foul the exchangers. The oxygen stripper feed is pumped and mixed with recycle gas stream. The combined feed is heated against the reactor effluent streams in the Cold Combined Feed Exchanger and Hot Combined Feed Exchanger. The combined feed is then heated to 300 to 316 °C in the fuel-gas-fired Charge Heater before it enters the first reactor. Reactor I has down-flow design and consists of guard bed, metal trap along with catalyst and mainly removes sulfur, nitrogen and saturates olefins. Reactor II is used to handle recombination sulfur. The Hot Combined Feed Exchanger is used for heat removal between the reactors so that the maximum temperature in the second reactor remains within the range of 316 – 343 °C. In order to control the high heat of reaction that may occur due to high concentration of coker naphtha in the feed, a control scheme is implemented where high reactor temperatures are controlled by reducing the feed rate.

The cooled reactor effluent is mixed with wash water before final heat removal in the air cooler Products Condenser located before the Separator. The Separator operates at 600 psig (42.18 kg/cm<sup>2</sup> (g)). Make-up gas, hydrogen from the CCR Platforming unit, is compressed in Make-up Compressor and is fed to the unit upstream of the Products Condenser. The separator vapor or recycle gas is compressed in the Recycle Compressor. The compressed recycle gas is mixed with the naphtha feed and sent to the Cold Combined Feed Exchanger.

The separator liquid is sent to the NHT Stripper where entrained sour gases and sour water are removed from naphtha. The net overhead vapor is sent to the Amine Absorber. The NHT Stripper net bottoms stream is fed to the CCR Platforming unit.

### **Feed Specification**



NHT unit processes typical blend of Straight Run and Cracked feed as per the following table. However, cracked feed is bound to change due to Refinery operating scenarios.

<b>Feed Stream (Boiling Point Range D 86)</b>	<b>Design Flow, TPH</b>	<b>Typical operating Flow TPH</b>
Straight Run Medium Naphtha (90-110°C)	21	10-25
Straight Run Heavy Naphtha (110-170 °C)	84	50-90
Petro FCC Naphtha (90-165°C)	3	0-10
Coker Naphtha (90-180°C)	20	0-30
Import Heavy Naphtha (90-170°C, < 1% olefins)	7	0-135

**Design case:**

The catalyst supplied shall be capable of processing and guaranteeing the combined feed High sulphur Nitrogen having the following range of Feed Specification.

<b>Combined Feed Specification:</b>		
<b>Properties</b>	<b>Unit</b>	<b>Specification</b>
Feed sulphur, Max, ASTM D4294/D5453	wtppm	2850
Nitrogen, Max , ASTM D4629	ppm	53
Density, typical, ASTM D 4052	Kg/m3	750
Distillation Vol% D86, typical, ASTM D86		
IBP	°C	89
5 %	°C	102
10 %	°C	105
20 %	°C	110
50%	°C	123
70%	°C	134
90%	°C	149
95%	°C	157
FBP	°C	175
Paraffins, ASTM D6839	Wt%	52
Olefins, ASTM D6839	Wt%	14.6
Naphthenes, ASTM D6839	Wt%	26
Aromatics, ASTM D6839	Wt%	16
Copper, ICP OES	Wtppb	15
Mercury, GF AAS	Wtppb	5
Arsenic, max, HYDRIDE ICP	Wt ppb	1

Lead, max, ICP OES	Wt ppb	20
Metals+Silicon, ICP OES	Wt ppm	1.5
Chloride as HCL, max, ASTM D4929	Wt ppm	5
<b>Diene value</b>		<b>1.45</b>

Design Feed is a mix of Straight Run Naphtha's from Crude Distillation Unit (CDU), Coker naphtha from Delayed Coker Unit (DCU) and Naphtha from FCCU from MRPL and sometimes import Naphtha.

**## The combined feed Anticipated diene number is less than or equal to 1.45**

**Typical Stream wise properties:**

ASTM D86	FCC naphtha	DCU naphtha	High Sulfur straight run Naphtha	Low Sulfur straight run Naphtha	Straight run heavy naphtha	Import naphtha
IBP	93	105	92	92	119	
5%	104	109	94	94	129	90
10%	116	113	96	96	139	
20%	122	115	96	97	143	
30%	128	118	97	98	147	110-130
50%	139	123	99	100	153	
70%	151	131	100	102	159	
90%	164	144	104	107	165	
95%	170	153	112	113	170	165 max
FBP	176	175	121	120	175	
ASTM D6839						
Paraffins	7	36	76	23	53	
Olefins	10	33	0	0	2	
Naphthenes	5	14	20	45	26	
Aromatics	78	17	4	32	19	

**Some of the Operating Constraints in NHT section presently with 2 reactors are as follows:**

Below operating constraints of NHT unit to be considered by vendor while designing the catalyst

- Maximum charge heater outlet temperature is 316 Deg C
- Maximum reactor-1 outlet operating temperature allowed is 356 Deg C
- Maximum Delta Temp allowed across Reactor -1 is 78°C
- Maximum DP bed allowed in Reactor -1 is 6 Kg/cm<sup>2</sup> (mechanical Limit)
- Maximum RGC head developed is 58.59 Kg/cm<sup>2</sup>(a)
- Maximum reactor-2 outlet operating temperature allowed is 343 Deg C

- g. Rated Recycle gas flow including supply to the second reactor is 47000 NM3/hr
- h. Rated MUG compressor discharge pressure is 44.65 kg/cm2(a)
- i. While doing heat integration of the loop, vendor to consider the existing historical data at less di-olefins and need to re-design to loop with keep the sufficient margin for each reactor operation.

### **3. PRE BID QUALIFICATION CRITERIA TO BE SUBMITTED IN EOI**

#### **PRE Qualification Criteria:**

1. Bidder should have been successfully completed the Design, licensing of Diene saturation reactor, preparing Basic Engineering Design Package (BEDP) containing design basis, PFD, Hydraulic evaluation of the Diene saturation related reactor circuit, process equipment data sheets, PIDs, instrument data sheets, as-built Equipment datasheet, De-pressuring system check, review of existing Interlocks and Cause and Effects, line schedule, flare load & and catalyst/chemical requirements Engineering and Construction management in Petroleum Refinery / Petrochemical complex / process industry in the past 10 years. Bidder should provide necessary documents and shall give copies of signed Agreement/ Work order/ Purchase order/ acknowledged final report or any other document to prove the scope of above completed works r to the satisfaction/verification of MRPL. Contact details of the reference company along with telephone, name etc. Other relevant documentary evidence for all the above mentioned criteria.
2. Bidders are required to sign a Non-disclosure Agreement (NDA)\* with the original licensor (M/s UOP) in licensors format and the same to be submitted along with EOI.
3. Also all the individuals who are going to be accessing UOP(Licensors) information during the project i.e. qualified team of engineers and project managers involved in the project to sign the personal NDA\* with the original licensor (M/s UOP) in licensors format and submit the same along with EOI.
4. Qualified team of engineers and project managers who are going to involve in the project and sign the personal NDA agreement above mentioned with licensors must have experience in such projects and Bidder needs to submit resume/relevant documents of project manager /engineers with previous experience details with this EOI.
5. The Bidder should not be under black list/ holiday list of MRPL/ Ministry of Petroleum & Natural Gas (MoPNG). Bidder shall give a declaration to this effect.
6. MRPL reserves the right to verify the originals of the documents submitted. Further MRPL reserves the right to complete the evaluation based on the details furnished without seeking any additional information.

Note1: MRPL has prepared this document to give interested parties background information on the project. While MRPL has taken due care in the preparation of the information contained herein and believes it to be accurate, neither MRPL nor any office authorities, officers, employees, agents/and advisors gives any warranty or make any representations, express or implied as to the completeness or accuracy of the information contained in this

document or any information contained in this document or any information which may be provided in connection therewith.

Interested parties are required to make their own inquiries and respondents will be required to confirm in writing that they have done so and they do not rely on the information provided in the EOI document in submitting their response. The information is provided on the basis that it is non-binding on MRPL or any of its authorities or agencies or any of their respective officers, employees, agents or advisors.

Also MRPL reserves the right not to proceed with the project, to alter the timetable reflected in this document or to change the process or procedure to be applied for listing of enquiry partners. It also reserves the right to decline to discuss the project further with any party expressing interest. No reimbursement of cost of any type whatsoever will be paid to persons, or entities, expressing interest in the project.

\*Note2 :MRPL shall not mediate NDA agreement and is completely bidding vendor's responsibility to approach the licensors and sign in the required format.

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Mangalore Refinery and Petrochemicals Limited ,SEZ Aromatic complex is a subsidiary of M/s. Oil and Natural Gas Corporation Limited (ONGC). MRPL proposes to invite Expression of Interest.

EOI Details as follows:

EOI No.	MRPL/AR/EOI/ 2023-2024/01
EOI on Website	From 30.06.2023 to 31.07.2023
Last Date foe queries/Seeking Clarifications	14.07.2023
Pre-EOI submission meeting with applicants for providing clarifications	24.07.2023
Closing date for submission of EOI	Upto 17:00 Hrs (IST) on 31.07.2023
EOI documents available at	<a href="http://www.mrpl.co.in/eoi">www.mrpl.co.in/eoi</a>

Please contact below mentioned personnel for further details:

Designation	Contact No.	Email id
CM (PROCESS ENGINEERING) AM(PROCESS ENGINEERING)	<b>9448983608</b> <b>8971749101</b>	<a href="mailto:srabhu@mrpl.co.in">srabhu@mrpl.co.in</a> <a href="mailto:mannu_jha@mrpl.co.in">mannu_jha@mrpl.co.in</a>

All Credentials/ Documents shall be addressed to

General Manager  
Materials Department  
Mangalore Refinery & Petrochemicals Ltd  
Kuthethoor PO, Via Katipalla, Mangalore – 575 030  
Karnataka- India

The envelope containing the documents shall be superscribed **“Study and implementation of Diene & Diolefin reactorat MRPL AROMATIC complex NHT section of CCR unit”**