

**Request for Proposal (RFP)
for
Operation & Maintenance
of
800 TPD Caustic Soda Plant at Dahej, Dist. Bharuch
Tender Enquiry No: GNAL/O&M/2020/RFP**

**Issued by
GACL-NALCO Alkalies and Chemicals Private Limited**

Aug. 1, 2020

Disclaimer

GACL-NALCO Alkalies & Chemicals Private Limited (GNAL) has prepared this document to invite qualified bidders to submit a Proposal for assisting in Operation and Maintenance(O&M) of a 800 TPD Caustic Soda Plant at Plot D-II/9/1 & D-II/9/2 near Village Rahiyad, Tal Vagra, District Bharuch, Gujarat, India.

2. While GNAL has taken due care in the preparation of information contained herein, neither GNAL, its Directors, employees or its advisors providing assistance to GNAL gives any warranty or make any representations, expressed or implied, as to the completeness and for purpose of accuracy of the information contained in this document or any information which may be provided in connection therewith. The information contained herein is not intended to be exhaustive. Interested parties are expected to make their own enquiries & due diligence. The bidders must confirm in writing that they have done so. They are advised not to completely rely only on the information provided in the RFP document in submitting their response. The information provided here is non-binding to GNAL, its Directors, employees and its advisors providing assistance to GNAL. GNAL reserves the right not to proceed with the initiative/ proposal as well as the right not to discuss the initiative/ proposal further with any bidder.

3. No reimbursement of costs or expenses of any type whatsoever will be paid to bidders or any other persons, or entities expressing interest in the initiative for purpose of submitting an RFP response and to this end, no bidder shall have any claim against GNAL, its Directors, employees or its advisors providing assistance to GNAL, arising out of any matter relating to this RFP document of any nature whatsoever whether or not any circumstances arising as a result of such claim is based on any act or omission by GNAL, its Directors, employees or its advisors providing assistance to GNAL whatsoever and/or the content of this RFP.

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1.1 Invitation for Bids (IFB)

- A. **GACL-NALCO Alkalies & Chemicals Private Limited**, (hereinafter called 'Owner' or 'GNAL'), is a joint venture (JV) company of Gujarat Alkalies and Chemicals Limited (GACL), (a Government of Gujarat promoted company) and National Aluminium Company Limited (a Government of India Navratna Company). This JV i.e. GNAL is also setting up an 800 TPD Caustic Soda Plant (CS Plant) with an integrated 2x65 MW coal-based Captive Power Plant at Dahej, Dist. Bharuch, Gujarat. The products manufactured at this plant will be marketed by GACL as its Sole Commission Selling Agent. GNAL intends to engage services of a reputed Contractor / Operator to assist it in management of entire Operation & Maintenance (O&M) of the Caustic Soda Plant (CS plant or CSP). The Contractor must have relevant experience of Operating & Maintaining continuous Chlor-Alkali / chemical / petrochemical / fertilizer / pharmaceutical plant/s, and having its executives, managers, engineers and other technical personnel with relevant experience and first-hand knowledge of managing a chlor-alkali plant operations and activities. It would be the sole responsibility of the O&M Contractor / Operator to engage competent staff and operate the plant efficiently to achieve the target production as set forth by GNAL. The plant will be operated with the highest level of safety, with all statutory compliances and as per the guidelines given in Operation Manual provided by the process licensors and/GNAL. All these will take place under the guidance and directions of a competent GNAL management team.
- B. GNAL, hereby, invites proposal from the prospective bidders, for assistance in Operation & Maintenance of 800 TPD Caustic Soda Plant (CS Plant or CSP) as explained in this document. It is being constructed at Plot D-2/9, Dahej Industrial Estate, Dist: Bharuch, Gujarat, India.
- C. The CSP is being set up with process licence as well as Engineering, Procurement and Construction Management (EPCM) services provided by M/s thyssenkrupp Industrial Solutions Pvt. Limited- formerly known as "Uhde" (tkIS). They have also supplied their proprietary electrolyzers for the CS Plant. Brief description/details of the CS Plant, the Block diagram and layout are given in Annexure-1.
- D. The products include Caustic Soda 48% lye, Caustic Soda flakes, liquid chlorine, evaporated chlorine, hydrogen gas, hydrochloric acid - 32%, sodium hypochlorite and sodium sulphate.
- E. The O&M operator shall provide Operations and Maintenance services (O&M) in the management of entire CS Plant, which includes, but not limited to, entire control room functions of all sub-plants, quality control, receipt and storage of bulk raw materials, product storage, packing, despatches, safety & environment compliance, other statutory compliances etc. The handling and disposal of the wastes, especially sludge in accordance with prescribed process is also within the scope of the O&M contractor. The plant should be maintained in a healthy condition through scheduled preventive maintenance to achieve maximum plant availability factor. It also includes maintenance required during the planned shut- downs. More details on the routine activities required to be carried out and estimated manpower deployed in different areas for a similar plant are provided in Annexure 2. GNAL will provide the raw materials, auxiliary materials, spares

and consumables. Most of the utilities will be provided from a captive power plant, which will be operated & maintained by a separate agency. The selection process for such an agency is going on.

- F. GNAL will engage specific other agencies for Offsite facilities like Fire Safety, security at the site, Surveillance through CCTV, Occupational Health Center, Centralized Stores, Centralized Control Room etc.
- G. For critical equipment and instrumentation, GNAL may tie up for a Non - comprehensive Annual Maintenance Contracts (AMCs) with the respective Original Equipment Manufacturer (OEM) or with their authorized service providers. The O&M Contractor may have to tie up for non-comprehensive AMC (Service part only)/ Annual Rate Contract (ARC) for O& M services. A tentative list of such AMC/ARC is given in Annexure-3.
- H. The period of the contract will be five years from the date of a taking over the plant for O&M services after the pre-commissioning and commissioning activities are over. The agreement at GNAL's discretion, on satisfactory completion, may be extended on mutual agreement for a period of further Five years or any other period. An estimated period of six months for pre-commissioning and commissioning support may precede the commencement of the first contract period.
- I. On selection, the selected O&M Contractor will enter into a definitive Agreement with GNAL. Within two weeks of signing of the Agreement, it will present a plan and implement it by deputing its qualified engineers, specialists and technicians etc. in each of the requisite areas. The O & M Contractor along with Owner's nominated plant managers will assist the Owner in ensuring that the consultant M/s tkIS delivers the CS Plant as per the EPCM Contract starting the pre-commissioning and commissioning period. On successful Commissioning, the O&M Contractor shall take-over the operations and maintenance (O&M) of the CS plant.
- J. To improve the competency of the staff engaged and to brief them the operating procedures, GNAL will provide relevant training to O&M Contractor's select personnel free of cost at GACL's plant in Dahej and /or Vadodara. Such training shall be subject to separate terms and conditions as may be agreed by GNAL with GACL. There will not be any cost to O & M Operator except for indemnifying GACL for all liability in respect to the death or personal injury, loss of or damage to the property of GACL.
- K. Though, it is intended to award the O&M contract for the entire Caustic Soda Plant, GNAL reserves its right to split the Operation & Maintenance Contract amongst several Contractors for various sections such as (a) Salt handling, Brine preparation, Brine treatment and Cell-house (b) Chlorine treatment, Chlorine Compression, Chlorine liquefaction, Chlorine storage, Chlorine filling in tonners, Chlorine Evaporation, Waste Air de- chlorination (Hypo) & HCL units (c) Caustic Concentration and Flaking plant including bagging and (d) Quality Assurance & Control.
- L. The Contractor shall be responsible for ensuring the quality standards at all the stages of production, including confirmation of the quality of raw materials /

auxiliary materials issued by GNAL, which will set up a well-equipped laboratory, which shall be operated and maintained by the O&M Contractor, who will deploy well qualified personnel for all quality control related activities. GNAL will provide all major consumables required at the laboratory, as requisitioned by the Contractor as per the terms of the contract.

- M. The Contractor shall also be responsible to ensure that the products dispatched to the customers must meet all required quality standards. The O&M Contractor shall provide all necessary support in attending the customers' complaints as requested by GNAL. For any off-grade products, if owner incurs any cost for disposal of the product in a manner as it deems fit, or incurs the expenditure for the additional consumption of the raw materials and/or utilities while reprocessing the material (loss), the Contractor shall be responsible for such loss. Besides reimbursing this loss, the Owner may impose a penalty not exceeding 10% of the loss incurred to cover the administrative cost.
- N. GNAL shall provide broad guidelines on the required production levels and shall monitor the operation & maintenance carried out by the O & M Contractor with the help of its Team of Executives. A tentative Organogram of the GNAL personnel overseeing the Operation & Maintenance of the Plant is provided in Annexure 4. The Contractor shall work in close co-ordination with the GNAL Team, so as to operate the plant efficiently, while keeping it safe and in good health.
- O. The Contractor shall follow the industry best practices for the operation and maintenance services. Standard maintenance procedures as recommended in Technology Suppliers/GNAL's maintenance manual shall be strictly followed. In addition, any specific guidelines issued by the Owner shall be followed by the O & M Contractor. In case of any discrepancies, the decision /interpretation of the Owner shall be final and binding to the Contractor.
- P. Pre-bid meeting(s) will be organized to provide all required clarifications and, subsequently, the RFP will be fine-tuned, if required. All clarifications required must be communicated / emailed to GNAL preferably a week prior to the date of all Pre-bid meetings, when all issues would be resolved.
- Q. The bids shall be considered only from those bidders who are meeting the following criteria:
 - a. Bidder should commit to engage the competent staff who have the following experience:
 - i) Operation and maintenance services, including control room operations of large continuous chemical plants, preferably, caustic soda plant of capacity not less than 300 TPD, for a continuous period of 3 (three) years or more;
 - ii) Operations & Maintenance of equipment like material handling system, clarifier, ion exchange separation, electrolysis cells, turbo compressors, refrigeration, liquefaction, evaporation, Pressure Swing Absorption (PSA) systems, flaking, packaging etc.

- b. The Bidder should have an annual turnover of at least INR 100 crores in each of the last 3 Financial Years. For this, the bidder must submit audited annual report for each Financial Year along with Balance sheets, which is duly approved by its Chartered Accountant.
- c. The Bidder should have earned profit before tax in at least 3 (three) years out of last 5 years.
- d. The Bidder should confirm by a statement that it has a long-term interest in carrying out such type of work in India.
- e. The Bidder should have a satisfactory record and experience of having kept the plant/s operated in efficient, reliable, continuous service for the entire term of the contract. Details in respect of all above must be provided by the Bidder and substantiated by recommendations from the Owners of plants that the Bidder had managed in last three years or are being managed.
- f. Bidder's relevant employee(s) proposed to be placed at CS Plant must have a complete knowledge and experience of operation of 'Plant Production & Maintenance Module' and 'Materials Management Module' of SAP. This will include creation/release/closure of maintenance notification, maintenance work order, reports generation, maintenance planning, etc. As regards Materials Management module, the Bidder's staff should have knowledge of SAP's functions in handling receipt/issue/return/inspection of materials, planning of materials requirement and reports generation, etc.
- g. Bidder shall demonstrate his knowledge and experience of safety & environment, regulatory and compliance aspects from his previously handled operations of large chemical plants, preferably a caustic soda plant.
- h. On a specific request some of the criteria as listed above, especially those related to requirement of direct experience of the bidder in relevant areas may be relaxed, provided the bidder submit a plan to manage it subject to satisfaction of GNAL. This will be at the sole discretion of GNAL. For this, bidder should include a mitigation plan for which he would be employing, on long term basis, senior level personnel having requisite experience. In such cases, the CVs of such personnel should be provided with the technical offer to GNAL. The award of job would be subject to engaging such competent personnel by the bidder.

1.2 Definitions

- 1.2.1 The following words and expressions shall have the meanings hereby assigned to them:
 - i. **"Abandonment"** means the voluntary cessation of performance of obligations by the O&M Operator in respect of the whole or any material part of the Contract, for reasons other than a Force Majeure Event, for a continuous period of 30 (thirty) days. For this purpose, but without limitation to the generality of the foregoing, the O&M Operator shall be deemed to have abandoned the Contract if it shall make or fail to make a decision, or shall take or fail to take any action clearly indicating the cessation of performance by it of its obligations in respect of the whole or any material part of the Contract for reasons

other than a Force Majeure Event, for a continuous period of 30 (thirty) days. The terms “**Abandon**” and “**Abandoned**” shall be construed accordingly.

- ii. “**Adjudicator**” means the person or persons named to make a decision on or to settle any dispute or difference between the Owner and the Contractor referred to him or her by the parties.
- iii. “**Change in Law**” shall mean the occurrence of any of the following after the date of execution of the Contract:
 - a. the enactment or issuance of any new Law, statute, rule, regulation, ordinance, order, decree, injunction, governmental authorization, agreement, decision, instruction, direction or notification of a Competent Authority or court or tribunal of competent jurisdiction including, without limitation, any law, statute, rule, regulation, ordinance, order, decree, injunction, agreement, decision, requirement, instruction, direction or notification relating to any existing taxes, import fees or assessments, import restrictions or any expropriation, compulsory acquisition or government taking;
 - b. any amendment, extension, appeal, modification or authoritative change in interpretation or application or repeal of any existing Law during the existence of the Contract.
 - c. any change of conditions to any Relevant Consent.
- iv. “**CLM**” means the Chloromethane Plant of GACL located adjacent to the site of GNAL.
- v. “**Commissioning**”: Commissioning activities consist of activities associated with running or operating the plant and include operating adjustments necessary for satisfactory operation of the plant or part thereof.
- vi. “**Competent Authority**” means any national, state, local, regional, territorial or municipal government or quasi government, ministry, governmental department, commission, board, bureau, agency, instrumentality, executive, legislative, judicial or quasi - judicial or administrative body, having jurisdiction over the CS Plant, the Owner or the Contractor.
- vii. “**Contract**” means the Contract or Agreement entered into between the Owner and the O&M Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract and the term “the Contract” or “Agreement” shall in all such documents be construed accordingly.
- viii. “**Contract Documents**” means the documents forming Contract Agreement (including any amendments thereto).

- ix. **“Contractor’s Personnel”** shall mean each individual and the collective group of Contractor’s employees and their respective employees, licensees, invitees, agents and representatives, who are provided and/or utilized by the O&M Contractor for the performance of the Work.
- x. **“Contract Price”** mean shall have the meaning given to such term in Clause 5.24.1.
- xi. **“CPP” or “CP Plant”** means the 2x65MW Captive Power plant of GNAL which is located at the same site as GNAL
- xii. **“CSP” or “CS Plant”** means the 800 TPD Caustic Soda plant which is the process plant of GNAL
- xiii. **“Day”** means calendar day of the Gregorian Calendar.
- xiv. **“DGVCL”** means Dakshin Gujarat Vij Company Limited” who is the Power distribution company for the region GNAL is being set up
- xv. **“Environmental Standards”** means all Laws, codes, rules and regulations relating to: (a) pollution, contamination, clean-up, protection and reclamation of the environment; (b) health or safety, including, without limitation, the exposure of employees or other Persons to any Hazardous Material; (c) the release or threatened release of any Hazardous Material; (d) the management of any Hazardous Material, including, without limitation, the manufacture, generation, formulation, processing, labeling, distribution, introduction into commerce, registration, use, treatment, handling, storage, disposal of material, the discharge of chemicals, gases or other substances or material into the environment, the presence of such material chemicals, gases or other substances in or on the Facility, transportation, reuse, recycling or reclamation of any Hazardous Material; and (e) any governmental approval issued by a Competent Authority with respect to the foregoing.
- xvi. **“Facilities”** means the CS Plant to be operated and maintained by the Contractor under the Contract and such other works as may be necessary for successful operation of the CS Plant in accordance with the specified technical and operational parameters.
- xvii. **“GACL”** Means Gujarat Alkalies and Chemicals Limited who is one of the promoter companies of GNAL.
- xviii. **“GCC”** means the General Conditions of Contract.
- xix. **“Hazardous Material”** means (i) any element, compound, substance, chemical or biological derivative, radiation, noise, vibration, material or combination thereof which by reason of its composition or characteristics is defined in Applicable Law as a hazardous material, or (ii) any other material which any Competent Authority shall determine from time to time is harmful, toxic, or dangerous, or

otherwise ineligible for handling, storage or disposal by unregulated means.

- xx. **"Laws"** means the substantive or procedural laws of any government agency or legislature, national, state or local, in India, including all acts, approvals, rules, notifications, statutes, orders, decrees, injunctions, instructions having force of law, governmental authorizations, regulations of any Competent Authority, legislature or statutory authority having jurisdiction over the matter in question
- xxi. **"Major Sub-Contract"** means any sub-contract entered between the Contractor and a Sub-Contractor, in relation to the Facilities, for an annual value exceeding 5% percent of the Annual O&M Fees of the Contractor or Rs. 1.0 Cr per year whichever is lower and the term "Major Sub-Contractor" shall refer to such Sub-contractor who has entered into a Contract with the O&M Contractor.
- xxii. **"Month"** means calendar month of the Gregorian Calendar.
- xxiii. **"NALCO"** Means National Aluminum Company Limited who is one of the promotor companies of GNAL.
- xxiv. **"O&M Fee"** means the annual amount quoted by the Bidder in its Price Bid, accepted by GNAL after negotiation.
- xxv. **"Operator" or "Contractor"** means the person(s) whose bid to perform the Contract has been accepted by the Owner and is named as such in the Contract Agreement, and includes the legal successors or permitted assigns of the Operator/Contractor. **"O&M Contractor"** and **"O&M Operator"** would be one and the same thing for interpretation of this contract document.
- xxvi. **"Operator/Contractor/O&M Operator's Representative"** means any person nominated by the Operator/Contractor/O&M Operator and approved by the Owner.
- xxvii. **"Operating Tenure"** shall mean the time period for which the plant shall be operated by the Contractor.
- xxviii. **"Owner"/"GNAL"** means GACL-NALCO Alkalies & Chemicals Private Limited and includes its successors and permitted assigns.
- xxix. **"Owner's Representative"/** Engineer In Charge is the authorized representative who shall act on behalf of the Owner for conducting defined duties / responsibilities / authority.
- xxx. **"Pre-commissioning"** - The Pre-commissioning is one of the preparation activities that involves the verification of functional operability of elements within the system to achieve a state of readiness for the Commissioning and Start-up operation.

- xxxi. "**Prudent Industry Practice**" means those practices, methods, techniques and standards, as updated from time to time and the exercise of that degree of skill, diligence and prudence that are generally accepted for use in the international electric utility industry which would reasonably and ordinarily be expected from a skilled and experienced O&M Contractor.
- xxxii. "**Relevant Consent**" means any consent, license, approval, registration, permit, sanction or other authorization of any nature which is required to be obtained, maintained and complied with under the Law for undertaking, performing or enforcing the obligations contemplated by the Contract or otherwise in connection with the equipment and the CS Plant.
- xxxiii. "**SCC**" means the Special Conditions of Contract.
- xxxiv. "**Site**" means the land and other places upon which the Facilities are installed, and such other land or places as may be specified in the Contract as forming part of the Site.
- xxxv. "**Spares**" shall mean the Mandatory Spare, Recommended Spares and Critical & Other Spares required for the operation and maintenance of the Facilities.
- xxxvi. "**Sub-Contractor**", means any person to whom execution of any part of the Facilities is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.
- xxxvii. "**Term**" means the term of the Contract by a 5 year Operating Tenure which is extendable for further five years, as mutually agreed between the Owner and O&M Operator, based on the performance and review by GNAL.
- xxxviii. "**Third party**" shall mean any party other than Owner, Owner's Personnel, Contractor, Contractor's Personnel, all Subcontractors appointed by Contractor either directly or indirectly and their respective employees, representatives and agents.
- xxxix. "**Time of handover**" shall mean the time when the Operation and Maintenance services in part or in full has been taken over by the O&M Contractor/Operator/O&M Operator from the Owner and the Contractor is bound to achieve the predefined targets from the facilities as required by the Owner.
- xl. "**tkIS**" means thyssenkrupp Industrial solutions (India) who is the EPCM consultant to GNAL for its Caustic Soda Plant.
- xli. "**Willful Misconduct**" means, with respect to any Party an intentional and conscious, or reckless, disregard by such Party of any Laws of India, any common duty of care for any provision of the Contract or

any other document prepared pursuant to the Contract and relating to the performance by such Party of its obligations thereunder.

1.3 Scope of Services and the Terms of Contract

1.3.1 Scope of Services

- 1.3.1.1 Subject to the responsibility as outlined in the scope of the Owner in clause 1.3.5 in this document, the O&M Operator's obligations cover satisfactory performance in rendering the services required for pre-commissioning & commissioning support and the O&M services as per the contract to meet the performance targets. Such services shall include, but are not limited to, the pre-commissioning and commissioning support, the provision of control room operations and other related O&M services; the supply and monitoring of staff and labour, procurement of minor goods, hardware and services for monitoring the Plant Performance, Optimization and Diagnostics and tools & tackles as well as mobile equipment other than those provided by GNAL, as required for comprehensive O&M services at the facility. As far as possible manual operation in O&M would be kept at minimal by bringing in automation, which could be discussed as and when such need is identified with the selected O&M operator. This may also include all such activities that are required for day to day O&M of the plant including but not limited to Scheduled maintenance work, Unscheduled (breakdown) maintenance and preventive & predictive maintenance work and all other allied activities as may be required for smooth functioning of the Caustic Soda Plant.
- 1.3.1.2 The O&M Operator shall organize a Team to provide various services listed below to operate and maintain the Caustic Soda plant. These are illustrative but not exhaustive in nature:
- a. Provide pre-commissioning and commissioning support to GNAL including training at GACL's plant for efficient commissioning of the units from the date of mobilization till achieving synchronization of each unit and subsequent/ post take-over, Operations and Maintenance including the achievement of Commercial Operation Date (COD), Guarantee Test Run (GTR) and further stabilization of Units,
 - b. Prepare / update operation and maintenance schedules and follow diligently instructions to a standard which will ensure that the plant is operated and maintained in such a way that it meets the manufacturers' instructions and helps in optimizing its technical and commercial performance of the plant. The O & M Contractor shall acquaint themselves with the existing procedures of Preventive and schedule maintenance of Caustic soda plant of GACL as a guidance.
 - c. Operate and maintain the plant according to the requirements and the instructions received in pursuant to the O&M contract,
 - d. Ensure periodic and pertinent training of the technical staff engaged for the plant on technical and safety aspects,
 - e. Undertake periodic performance tests on behalf of the GNAL and report / upload the results to GNAL online within a reasonable time,

- f. Recommend to GNAL any remedial action which the O&M Operator considers necessary to maintain or improve performance or to correct any deficiencies revealed during plant operation or arising from inspection or analysis of test results, provided that it would be at GNAL's sole discretion to accept such recommendation,
- g. Maintain operational logs, operational and maintenance records and a register of plant items and store all records relevant to availability and compatible with GNAL's SAP system throughout the term of the Agreement,
- h. Operate such personnel policies so that operation and maintenance team remains motivated throughout the term,
- i. Supply and meet safety systems with a view to comply with Applicable Laws, and the maintaining of high safety performance and of an acceptable safety standards,
- j. Absorb GNAL values in a manner so as to maintain and ensure a public profile of GNAL as one that cares for the environment by responsible management of all activities. It shall assist GNAL to report environmental performance to the authorities as required by the Licence or under any law,
- k. Carry out housekeeping and environmental care procedures & Compliances,
- l. Plan the requirement of spares and major consumables judiciously and in advance with a view to ensure that plant performance is not jeopardised for lack of spares and consumables availability and at the same time, to ensure that undue inventory is not built up,
- m. Keep the staff aware and trained in fire, first-aid and emergency procedures, maintain adequate site based first aid and firefighting facilities and using the common fire tenders to help in emergencies in the Caustic Soda Plant and in line with statutory requirements and the directions of the District administration,
- n. Promote good relations with the local community and with relevant local authorities,
- o. Maintain the administrative systems compatible with GNAL's SAP system, which will provide accurate records of all technical parameters like production of caustic soda and other products, Raw material consumption, Power and Utility consumption, Availability of raw materials and chemicals, waste generation, plant records, stores, contracts and other matters as required,
- p. Assist in organising and managing such contracted and subcontracted maintenance, repair and testing services as shall be required to carry out scheduled inspections, overhauls and major breakdown repairs including the statutory overhauls approval from statutory body,
- q. Carryout the dispatch instructions set out in the offtake arrangements,
- r. O&M including repairs of Public Address (PA) systems,
- s. Update the "as built" drawings time to time for the operation and maintenance of the Caustic Soda Plant,
- t. Make 'Availability Declarations' on SAP or otherwise on daily basis and assist GNAL in submitting invoices under the offtake arrangements,
- u. Comply with the state Government/GIDC policies on local employment,
- v. Maintain accounts, books, records and information systems on SAP or otherwise relating to the operation and performance of the plant including running hours and number of starts available to GNAL on reasonable notice,
- w. Attend to meetings with GNAL and such other persons as GNAL may specify from time to time on reasonable notice with regards to O&M services,
- x. Prepare and submit to GNAL 'Progress Report' in accordance with O&M contract (Periodically – daily, weekly, fortnightly, monthly, quarterly, half yearly, yearly, etc.) As far as possible all reports will be prepared on SAP,

- y. Comply with all statutory requirements and assist GNAL in reporting the same to statutory authorities. Statutory clearance/Renewal from IBR, PESO, Electrical inspector, Inspectorate of Weights and Measures, GPCB, and other statutory compliances Contractor's scope. All statutory payments to the statutory authorities will be borne by the Owner and paid on recommendation by the O&M Contractor,
- z. Manage Utility and chemical supply to the CPP and GACL in the same campus as per quantum required, and
- aa. Co-ordinate with OEM / AMC / ARC agencies for maintenance of the critical equipment / items for which GNAL has either directly entered into AMC or O&M Contractor may enter into such AMCs / ARCs

The above is not an exhaustive but an illustrative list of scope of services. The appointed O&M Operator shall carry out and/or assist in all such activities related to the O&M of GNAL's CS Plant at Dahej, Dist.Bharuch.

1.3.2 Time for Handover to O&M operator (Takeover process by O&M Operator)

The O&M Operator shall assist the Owner in supervising and providing necessary competent manpower both skilled and unskilled for the pre-commissioning and commissioning activities till the Guarantee Test Run (GTR) and subsequently takeover the O&M of the plant under the guidance of Team GNAL after it takes over the plant. During the Commissioning, the O&M contractor's team shall get familiarized with the Caustic Soda Plant, resources as well as existing processes and constraints before the COD.

1.3.3 Joint Audit

Before the handing over the Plant to the O&M Contractor, the Owner and O&M Contractor, shall conduct a joint audit and record the major systems, equipment and assets being handed over. The records of joint audit shall be signed by both the parties before takeover process after which the Operating Period will start. The fees for the O&M Operating period shall be payable from the take-over date by the O&M Operator.

1.3.4 Process of Handover from O&M Operator after completion of the Contract

At the end of Agreement term on account of its completion or termination due to any reason during the operating period, or after extension period if any, the Caustic Soda Plant shall be handed over back to the Owner in safe and healthy condition (with a reasonable wear and tear). The Owner and the O&M Operator shall conduct a joint audit and record the major systems, equipments and assets being handed over. The Compensation to GNAL by the O&M Operator for any damages / deficiencies observed in such audits shall be worked out mutually.

1.3.5 A Broad Division of Responsibility between GNAL and O&M Operator

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
1.	Role	Owner- Handing over the complete plant and machineries and other units	Complete Operation & Maintenance of Caustic Soda Plant as per the scope defined here.

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
		required for O & M of the plant	
2.	Pre-Commissioning & Commissioning	Coordination between EPCM Contractor(tkIS), other contractors and O&M Operator	Pre-commissioning and Commissioning support to GNAL from a date mutually agreed. Guarantee Test Run under the guidance of Owner and tkIS and O&M for achieving COD/PG Test and Stabilization of and the plant thereafter.
3.	Spares & Consumables	All major Spares and consumables will be procured by GNAL after due planning of procurement in advance as per GACL MM manual which may be shared with the selected O & M operator, if required.,. These shall be issued to the contractor from the central stores.	The O&M Operator will plan in advance for the requirement of spares and consumables and get the approval of the owner. with prior approval GNAL O & M operator may procure Minor spares/ consumable item that costs less than Rs 25000/- as a single purchase item on stand-alone basis. All such bills will be reimbursed monthly.
4.	Tools & Tackles	Tools & Tackles available with GNAL will be handed over to O&M Operator at the time of handover	With GNAL's prior approval to procure & maintain required Tools & Tackles
5.	Software and/or other tools for monitoring Caustic Soda Plant Performance, Optimization and Diagnostics	--	To procure & maintain software compatible to SAP with GNAL's prior approval for monitoring Caustic Soda Plant Performance, predictive/preventive maintenance, Optimization and Diagnostics, as required
6.	OEM Manuals, Test Reports, etc.	OEM Manuals, Test Reports, etc. will be handed over to O&M Operator at the time of handover	--
7.	Human Resources	GNAL team as per the organogram (Annexure-4) for the coordination of smooth functioning	To provide adequate skilled pre-commissioning and commissioning staff,

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
			<p>including supervisors at site from the date of mobilization till commissioning and thereafter for achieving PG test.</p> <p>To provide adequate skilled O&M staff and required unskilled manpower from the date of takeover till completion of term of agreement. This will also include skilled and unskilled workers for activities like Salt handling, Chemicals handling, cell maintenance, Chlorine tonner filling, Hydrogen filling, Caustic soda flakes bagging and stacking, filling into the trucks or rail with mounted tankers/wagons and loading various products as per requirements.</p>
8.	<p>Raw materials: salt and chemicals like : 1) Na₂SO₃ 2) BaCO₃ 3) Flocculent (Magnafloac) 4) Alpha Cellulose 5) Na₂SO₃/NaHSO₃ Any other chemicals as required</p>	<p>Procurement and Supply of Raw materials and chemicals by trucks at -Plant main gate / designated storage area under control of GNAL, as the case may be</p>	<p>From the specified main entry / agreed designated storage area in the Plant managing entire Raw materials and chemicals value chain including check in quality, quantity, logistics and handling, protection onwards. All operations including the internal handling, Weighing will be done by O&M agency with a GNAL's witness at GNAL's discretion/directions.</p>
	<p>Caustic Soda, Chlorine, HCL Sodium</p>		<p>O&M agency has to manage these products produced or procured or the utilities to CPP &</p>

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
	hypochlorite, Nitrogen		GACL's CLM plant at defined terminal points. Necessary records in SAP, metering of all supplied utilities need to be maintained as per the GNAL's requirement.
16.	Statutory Clearances	Payment of statutory fees and official communication as an owner.	Substantial assistance in obtaining statutory clearances & all licenses. Maintaining parameters as per statutory norms and assist in periodic inspections as decided by the respective authorities. All liaisoning expenditure.
17.	Effluents & Pollutants	Obtaining Initial Environment Clearance (EC) and Consent to Operate	Maintain effluents & pollutants levels as per statutory norms. Operation & Maintenance of the system to upload readings of emissions/ water solid as may be required by GPCB & CPCB and as per statutory norms. Disposal of the effluents / sludge and other waste materials as per agreed / prescribed procedures. Adhering to the requirements of the EC where O&M Operator has direct control and/or influence
19.	Maintenance of Caustic Soda Plant Civil Structures & Buildings including HCL Synthesis, Raw Salt handling, Clarifier Walkway, pipe Racks,	All Major maintenance activities including capital expenditure	With prior approval, any Routine minor maintenance up to a limit of Rs. 25,000 per item or per invoice to avoid any major damages on reimbursable basis. Assistance in getting repairs from any agency whom GNAL may engage to provide AMC

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
	Chemical Laboratory, inside plant offices, workshop, Admin Building, Stores and all Road repairs.		services for such repairs as not covered in O&M
20.	Weigh bridge, Caustic Soda Plant Internal Roads & fencing / boundary wall (Complete)	Initial installations and Major maintenance / capital expenditures	Complete Operation and maintenance as guided by the Owner's team. Certification as required of the weigh bridges and other similar equipment will be in the scope of the O&M operator
21.	Landscaping, Trees & Green Belt	Capital expenditure for Development activities will be done by GNAL	O&M contractors to ensure provision of watering etc. for the maintenance at the designated points as per GNAL within the boundary limits of the Caustic soda plant Keeping such areas intact with due care exercised during Operation & Maintenance Activities
22.	Housekeeping	Housekeeping in all other areas, not falling in the Caustic Soda Plant Area.	Housekeeping in Caustic Soda Plant and related area as guided by the Owner's team
23.	Plant Insurance	By GNAL with O&M Operator as Co-Insured & Waiver of Subrogation clause.	Inputs as and when required will be provided by the O&M operator during claims.
24.	Plant Personnel Insurance	GNAL to insure its own employees	O&M Operator to insure all persons working in Caustic Soda Plant on their behalf and to ensure that the manpower of all their sub-vendors are covered under insurance as per statutory norms
25	Canteen	GNAL would engage a AMC provider for managing the canteen where take-away services at a centralized or	Services on chargeable basis to O&M operator. Collection from a centralized place and

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
		at any other place would be made available. The centralized dining place will be made available	distribution within the plant as necessary.
26	Other Labor statutory provisions	Necessary Form-V shall be provided only to the principal O & M Contractor	O&M operator must get issued a labor license covering all types of Labor that it may source and comply with all statutory provisions of the Central or Gujarat State Labor Laws
27	Maintenance of major Plant Machineries and Package units	A) AMCs for items as provided in Annexure 3(a) B) Spares and Consumables, including spares initially procured for 2 years' trouble free operation	A) Maintenance assistance with required Skilled personnel and tools and tackles under the supervision of OEM representative with whom AMC would be entered into by GNAL B) O & M operator shall coordinate for OEM support under warranty.
28	AMCs (other than those provided / covered by GNAL)		A) AMCs through OEM (other than what is provided by GNAL-Annexure-3(a) or others required for O & M services of CS Plant. (B) AMCs for items provided in Annexure 3(b) and other equipment which would be brought by O&M Contractor
29	Use of equipment/fuel / material handling systems	The major equipment are as per Annexure-7, which GNAL would install and O&M operator to maintain	To be operated and maintained for those provided by Owner. Other requirement to be sourced by O&M operator. The diesel shall be bought by O&M Contractor. All mobile machineries Pay loaders (3-4nos) / fork-lifts (3-4 nos)) / JCB / hydras / cranes, as

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
			required for routine / O&M activities and periodic / schedule shutdowns.
30	Laboratories	Equip the Laboratory with required equipment with all relevant equipment /instruments and glassware. All required Reagents / consumables would be under the scope of GNAL, who will procure any equipment which the O&M Operator suggests and agreed by the Owner	Usage, maintenance, repair, calibration and upkeep of Lab equipment (electrical, instrumentation, mechanical, chemical). With prior approval of GNAL, Operator may procure upto Rs.25000/- on a single invoice for minor replacements of small broken glassware, and other consumables like tissues, wipes etc on reimbursable basis.
31	Firefighting equipment / fire tender	Owner will provide fire tenders (1 water and 1 powder) along with fire extinguishers, Spares and diesel required for O&M	O&M of firefighting equipment installed within the plant area including refilling and maintenance of fire extinguishers, consumables, hoses is in the scope of O&M operator
32	ISO 9001, ISO 14001/ OHSAS 18000, ISO 45001, ISO 50001	To be supported by the Owner, who will bear the cost for this. The certification work will be managed under the guidance and direction of the owner/consultant in the prescribed time limit.	O&M operator shall involve with the Owner in initiating the process, identifying the consultants, helping in finalizing their terms, and preparing documents, getting involved in the audits and getting the Certification.
33	Compliance to PAT scheme	GNAL would provide any necessary hardware and also liaise with GEDA and BEE using the information generated and provided by O&M Contractor. Engage the services for Energy Audit.	O&M Agency to ensure full compliance with the regulations, generate and provide all necessary data. Any penalty / outward payment GNAL may have to pay on account of negligence / non-compliance / inefficient operations shall be to the

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
			account of O&M Contractor
34	Surveillance camera system, PA system, Internet, VC CCR	Provided by the owner who will provide for the AMC costs	O&M Contractor to use the system diligently, and liaise with AMC agency for reporting any maintenance requirement within the CS Plant area
35	Fabrication and erection of up to 5 MT /Quarter of steel in addition to day to day O&M items and repairs		Supply & fabrication and erection (excluding day to day O&M) up to 5 MT/month each. Consumables like welding rods etc. in the scope of O&M Contractor. GNAL would reimburse the cost of material against documents and evidence of its usage. Prior approval of GNAL would be required.
36	Cable laying up to 2 KM excluding cables damaged during plant running and O&M	Cable shall be procured by the Owner.	Minor consumables up to a limit of Rs. 25,000 per month in the scope of O&M Contractor which will be reimbursed. The prior such expenses shall require prior approval of GNAL would be required.
38	Space and Covered storage sheds with racks, bins for Material & waste Management	Centralized Stores will be operated and maintained by GNAL. Sub-stores in plant area will be equipped by GNAL with racks etc. for O&M Operator to manage	Getting items issued from Centralized stores and transporting to sub-stores within the plant area. Handling & supervision by the O&M agency. Heavy duty equipment like Crane, fork lifts hydra, trailer, tractor trolley etc will be mobilized & maintained by the O&M contractor as per requirement accessed and agreed by the Owner.

Sr. No.	Description	GNAL's Scope	O&M Operator's Scope
39	Painting of Caustic Soda Plant Civil Structures & Buildings including HCL, SRS Building, workshop, Admin Building, Stores, boundary wall etc	All Painting activities other than touch up painting will be undertaken by GNAL.	Routine touchup painting including labor cost up to a limit of Rs. 25,000 per month on reimbursable basis against documents and evidence of its use. Prior approval of GNAL would be required. Damage due to negligence by the O&M contractor or its staff will be in the scope of the O&M contractor
40	IT infrastructure	GNAL to provide for IT infrastructure including IT network, desktop/laptops, printers, photocopier etc for using SAP including its licences and other software	O&M Contractor to ensure that its staff is computer savvy and can manage the hardware provided for usage with all the Internet connections for all working in the plant. The other computers to be used by the staff of O&M Operator for their own accounting etc. shall be brought by O&M Operator. No O&M details of the plants should be stored in these computers.
41	All type of lubricants which go into the system / equipment.	GNAL will procure and supply all type of lubricants and Oil required for conditioning the machines.	Handling the above material to be done by O&M Operator. Oil conditioning & testing shall be done by O&M operator. However the consumption and frequency of replenishment/replacement will be as per the recommendation of the OEM and recorded in the software provided by GNAL

1.3.6 Boundary Limits of the O&M Scope of work:

All boundary limits are as per Annexure 6, which would be updated and agreed at the time of handing over CS Plant to O&M Contractor for O & M Services. These boundary limits define the points up to which O&M Contractor shall have full

responsibility, and beyond which some other agencies would be in control and responsible. During emergencies, these limits should not stop the O&M contractor for their actions required beyond such limits to bring the situations under control in collaboration with those other agencies.

1.3.7 Capital Expenditure

Assessment of requirement for capital expenditure will be jointly made in the last quarter of the every calender year (October-December) to enable budgetary provisions to be made by GNAL in their annual budget for the next year. With support from O&M Operator’s employees, GNAL will procure necessary capital equipments/spares, provided, however that GNAL’s decision, to procure or not any capital equipments/spares, shall be final and binding to the O & M Operator. The O & M Operator shall ensure avoidance of unplanned capital expenditures with meticulous planning and systematic maintenance of CS Plant.

1.3.8 Maintenance Responsibility Matrix

S No	Activity	OEM		Work supervision		T&P manpower		Consumables & Spares	
		Cost	Arranged by	Cost	Arranged by	Cost	Arranged by	Cost	Arranged by
1	Annual Overhauling	O AMC	O AMC	O&M	O&M	O&M	O&M	O	O
2	Breakdown and corrective maintenance	O&M/O if Insurance (If applicable)	O&M/O	O&M	O&M	O&M	O&M	O	O
3	Preventive maintenance	AMC	AMC	O&M	O&M	O&M	O&M	O	O
4	Routine Maintenance	AMC/O&M	AMC	O&M	O&M	O&M	O&M	O	O

OEM: Original equipment manufacturer O – Owner, O&M – O&M contractor T&P: Tools & Plant

For avoidance of doubt, all material costs for Capital Overhauling activities is in the scope of Owner.

1.3.9 Terms of Contract

O&M contract shall include an estimated six months’ pre-commissioning and commissioning support period followed by a 5-year Operation and Maintenance period. Base on the performance and review this can be extended on mutually agreed terms between the OWNER and O & M operator for further five years. 6 months of pre-commissioning and commissioning period will be considered for CSP (until GTR) 5 years’ time period will be considered from the date of takeover of the last unit by the O&M Operator, if GTR is delayed.

1.3.10 Site Visit

It is strongly recommended that the bidders should visit the site to understand before submission of their bids and assess the current condition of upcoming Caustic Soda Plant at D II/ 9 Dahej, Dist. Bharuch and other facilities in the vicinity.

1.3.11 Bid Validity and Bid security

- 1.3.11.1 Bid validity Date: Four months of due date for submission of technical bid.
- 1.3.11.2 The Bidder shall furnish, as part of their Bid, a token refundable interest free Bid Security of Rs. 10,00,000/- (Rupees ten lac Only) in the form of Bank Demand Draft (DD) or a Bank Guarantee in a prescribed format favouring 'GACL-NALCO Alkalies and Chemicals Private Limited' Payable at Vadodara.
- 1.3.11.3 Bids without Bid Security shall be rejected.
- 1.3.11.4 The Owner reserves the right to accept or reject any variation or deviation in the bid.
- 1.3.11.5 The Owner in its absolute discretion has a right to amend / vary any of the conditions for invitation of the Bid.

1.3.12 Address for Communication

Regarding Submission of Bid Security, Bids & Queries:

Head of CS plant

GACL-NALCO Alkalies & Chemicals Pvt. Ltd.

401-403, Yashkamal building

Sayajigunj,

Vadodara – 390020, Gujarat

Email: Samit.panchal@gnal.co.in and
Thomas.Varughese@gnal.co.in

- 1.3.13 Only those bidders qualified through Qualification process are eligible to bid for this RFP (Request for Proposal).
- 1.3.14 Bidding Documents are not transferable.
- 1.3.15 GNAL, the Owner reserves the right to accept / reject, at its sole discretion, any or all bids without assigning any reason. No further correspondence shall be entertained in this regard.
- 1.3.16 Bidders are requested to read the bidding documents for complete details on the requirements as well as other terms and conditions of the contract.

Chapter 2

2 Instructions to Bidders (ITB)

A. General

<p>2.1 Scope of Bid</p>	<p>2.1.1 GNAL invites bids for the Operation and Maintenance Services (the “Services”) including the Pre-commissioning and commissioning support, as described under Scope of Services in IFB of the Bidding Document.</p> <p>2.1.2 The successful Bidder shall meet the performance targets for services. Details are provided in Section 6.</p>
<p>2.2 Cost of Bidding</p>	<p>2.2.1 The Bidder shall bear all costs associated with the preparation, submission and any incidental expenditures incurred on his Bid up to final Bid evaluation and subsequent award of the job. The Owner will in no case be responsible or liable for any of the costs incurred by the bidders.</p>
<p>2.3 Site Visit</p>	<p>2.3.1 The Bidder, at the Bidder’s own responsibility and risk, is encouraged to visit and examine the Site and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for the Services. The visit could be arranged with a prior appointment and the costs of visiting the Site shall be borne by the bidder.</p>

B. Bidding Documents

<p>2.4 Content of Bidding Documents</p>	<p>2.4.1 This RFP comprises the following:</p> <ul style="list-style-type: none"> Section 1 Invitation of Bids (IFB) Section 2 Instructions to Bidders (ITB) Section 3 Bid Data Sheets (BDS) Section 4 General Conditions of Contract (GCC) Section 5 Special Conditions of Contract (SCC) Section 6 Performance Guarantee (PG) Attachments and Annexures <p>2.4.2 The Bidder shall examine all the instructions, terms and conditions, and specifications in the RFP. Failure to furnish all information required by the RFP or to submit a bid not substantially responsive to the RFP in every respect will be at the Bidder’s risk and may result in the rejection of its bid. The bidder shall submit all the documents that add credentials to their candidature.</p>
<p>2.5 Clarification on Bidding Documents</p>	<p>2.5.1 To facilitate evaluation of RFP, THE OWNER may, at its sole discretion, seek clarifications in writing from any Bidder regarding its bid. All communication will take place only on email. Notwithstanding anything contained in the RFP document, GNAL</p>

	<p>reserves the right to not take into consideration any such clarifications sought by it for evaluation of the bid.</p> <p>2.5.2 A prospective Bidder requiring any clarification to the bidding documents may notify GNAL in writing by E-Mail at the Owner's address/s indicated in the Bid Data Sheets. The Owner will respond only by E-Mail to any request for clarification or modification of the bidding documents that it receives prior to a final pre-bid meeting. This will be last opportunity for the bidders to seek any pending clarifications.</p> <p>2.5.3 The Bidder and any of its personnel or authorized representative will be granted permission by the Owner to enter upon its premises and land for the purpose of inspection. However, only upon the express condition that the Bidder, its personnel and agents will release and indemnify the Owner and its personnel and authorized representative from and against all liability in respect thereof for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.</p> <p>2.5.4 The amendment if any, pertaining to RFP will be notified in writing through E-Mail to all prospective Bidders that have received the bidding documents and will be binding on them. Bidders are requested to immediately acknowledge the receipt of any such amendment by an E-Mail with comments, if any, within one week. Otherwise, it will be assumed that the Bidder in its bid have taken the information contained therein into account.</p> <p>2.5.5 In order to give prospective Bidders reasonable time to take the amendment into account in preparing their bid, the Owner may, at its discretion, extend the deadline for the submission of bids if circumstances demand so.</p>
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C. Preparation of Bids

2.6 Language of Bid	<p>2.6.1 The bid prepared by the Bidder, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Owner shall be in English. If supporting documents and printed literature furnished by the Bidder are in language other than English, the bidder must provide self-authenticated translation of the relevant passages in English.</p>
2.7 Documents Comprising the Bid	<p>2.7.1 The Bid submitted by the Bidder shall comprise the following:</p> <p>(a) Attachment 1: Bid Security Refer para 2.11 & para 3.6</p> <p>EMD shall be furnished in accordance with the bid document in a separate sealed envelope and clearly titled as "EMD" to be submitted to communication address of GNAL.</p> <p>(b) Attachment 2: Tools & Tackles and Software for O&M</p>

	<p>All special tools and tackles as required for cell element assembly shall be provided by GNAL. Those tools & tackles not available at GNAL Caustic Soda Plant at Dahej, Bharuch, and which may be required by the bidder in day-to-day O&M or for planned/un-planned shutdown shall be arranged by the O&M Operator on its own.</p> <p>The owner is using SAP platform. If operator intends to bring its own software, it must be compatible with the SAP. The price of the same must be included in the overall price for providing O&M services.</p> <p>(c) Attachment 3: Subcontractors Proposed by the Bidder</p> <p>The Bidder shall include in its bid details of all major items of supply or services that it proposes to purchase or hire on lease or subcontract and shall give details of the name and nationality of the proposed Sub-Contractor/s, including the Vendors, for each of those items. Bidders are free to list more than one Sub-Contractor / Vendor against each item of the facilities. The Owner reserves the right to not allow any proposed Sub-Contractor / Vendor from the list prior to award of contract. After discussion between the Owner and the O&M Operator, Contract Agreement shall be completed, listing the approved Sub-Contractor(s) / Vendor(s) for each item.</p> <p>(d) Attachment 4: Takeover Plan</p> <p>The bidder shall furnish a Takeover Plan, which shall include a proposed organization structure and the details of qualification & experience of all key personnel (at least up to top four levels).</p> <p>(e) Attachment 5: Deviations</p> <p>Any deviation that the bidder has considered with regard to the clauses in the bid document shall be mentioned in this section along with the reference to respective clause and a note on explanation on the deviation as well as rationale for the same. If these have price implication, it shall be specifically mentioned. All deviations must be explicit and stated upfront and discussed prior to submitting the Bid. Any deviations, which comes to notice later and have commercial implications may lead to cancellation of the Contract at Owner's Convenience.</p> <p>(f) Attachment 6: Certificate regarding Acceptance of all Conditions of RFP</p> <p>The complete RFP document, together with all the Annexures and Attachments shall be signed and stamped on each page by the bidder as a token of its acceptance <i>in-toto</i>, except for the deviations as mentioned in Attachment 5. The Bidder is encouraged to discuss it at the earliest prior to submitting the price bid, which once submitted may not be allowed to be modified.</p>
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	<p>(g) Attachment 7: Guarantees</p> <p>The O&M Operator shall provide a guarantee that the Caustic Soda Plant shall be operated faithfully, honestly and with due diligence and care. He shall execute, perform and carry out the work under this agreement with the highest standards of integrity, efficiency, safety and statutory compliances. The Contractor will, as a prudent operator, provide an effective supervision and monitor all the jobs of Operation and Maintenance awarded to maintain the plant in a healthy condition so as to achieve maximum life of all the parts of plant & machineries, particularly the electrolysis equipment including the Membranes, Anodes, Cathodes etc. The plant availability should be guaranteed for at least 350 days in a year. The plant should be able to operate at its full potential within 90 days of its commissioning, except for the factors absolutely not within the control of the Contractor. The other guaranteed parameters are listed in Chapter 6.</p> <p>(h) Attachment 8: Price Schedule – Break Up of Charges for Commissioning Support and Long-Term O&M</p> <p>The Priced part of the bid, <u>with no prices mentioned therein</u>, should be sent with the Technical Bid. The prices in the prescribed format must be submitted before the due date, but only when specifically advised to do the same through a separate communication. Technical bid must not indicate the price. If it is found to have prices mentioned, the Bid may be rejected. The ‘Price bid’ should be submitted strictly in the format provided and only when GNAL seeks it by a special communication for the submission of ‘Price Bid’.</p> <p>Price Bid with price schedule (duly filled) must be enclosed in a separate envelope and clearly titled as “PRICE-BID”.</p>
<p>2.8. Bid Prices</p>	<p>2.8.1 The Bidders shall quote for the scope of work on a “Single Responsibility” basis such that the total bid price covers all the O&M Operator’s obligations mentioned in or to be reasonably inferred from the bidding documents in respect of long term complete operation and maintenance of GNAL’S Caustic Soda Plant at Dahej, Bharuch.</p> <p>2.8.2 The prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract in accordance with the provisions of bidding document, if any. Otherwise, prices quoted by the Bidder shall be firm during the entire duration of the Contract.</p>
<p>2.9 Currencies of Bid and Payment</p>	<p>2.9.1 The prices shall be quoted by the Bidder in Indian Rupees (INR) only. It may be noted that all payment under contract will be made in INR only.</p>

<p>2.10 Bid Validity</p>	<p>2.10.1 Bids shall remain valid till four months from the date of submission of the Price Bid.</p> <p>2.10.2 In exceptional circumstances, the Owner may request bidders to extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing. A Bidder may refuse the request without having Bid Security amount forfeited. Only unconditional acceptance of request for such extension by Bidder shall be considered.</p>
<p>2.11 Bid Security</p>	<p>2.11.1 Bid Security amount shall be paid through a Bank Demand Draft or a Bank Guarantee in the prescribed format. No interest or fees in any form will be payable for the Bid Security.</p> <p>2.11.2 The Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the award of the Contract to the successful Bidder.</p> <p>2.11.3 The Bid Security may be forfeited:</p> <ul style="list-style-type: none"> (a) If the Bidder withdraws its bid during the period of bid validity specified by the bidder in the bid form. (b) If the Bidder does not accept the arithmetic correction of his Bid Price. (c) If the Bidder does not withdraw any deviation listed in Attachment which may have commercial implications or material impact on the performance of the desired job under the contract (d) In the case of a successful Bidder, if the Bidder fails within the specified time limit <ul style="list-style-type: none"> (i) to sign Contract Agreements (ii) to furnish the required Performance Securities and act as per the Contract agreements signed.
<p>2.12 Format and Signing of Bid</p>	<p>2.12.1 The Bidder shall prepare one original set of documents comprising the Bid and clearly marked "ORIGINAL." In addition, the Bidder shall submit 02 copies of the Bid and clearly marked as "COPY-1 & COPY-2." In the event of any discrepancy between them, the original shall prevail.</p> <p>2.12.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the Bid where entries or amendments have been made shall be initialed by the person or persons signing the Bid along with a stamp of the Company he represents.</p> <p>2.12.3 The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Owner, or as necessary to correct errors made by the Bidder, in which case</p>

	such corrections shall be initialed by the person or persons signing the Bid.
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D. Submission of Bids

<p>2.13 Sealing and Marking of Bids</p>	<p>2.13.1 The bid document shall be divided into two sections:</p> <p>A. Technical Bid’</p> <p>Technical Bid would comprise of all the bid documents, including Commercial terms and condition and Price Schedule <u>but without price</u> – while indicating the word ‘Quoted’ against each price entry, Bid Security.</p> <p>And,</p> <p>B. ‘Price Bid’.</p> <p>The Price bid shall comprise of the Price Schedule as per the format provided in Attachment 10 or as modified and notified later.</p> <p>C. These documents shall be submitted separately, as and when advised, in double sealed envelopes duly marked as (1) “TECHNICAL BID” and/or (2) “PRICE BID” respectively. When and if asked to submit both the bids at the same time, these 2 envelopes shall then be sealed in an outer envelope duly marked as “TECHNICAL & PRICE BID”.</p> <p>D. The bid security shall be furnished in a separate sealed envelope, duly marked the envelope as "BID SECURITY" and this envelope shall then be sealed in outer envelope duly marked as "BID SECURITY".</p> <p>E. The copy of the bid documents submitted by the bidder should also be packed in a similar way and should clearly be denoted as “COPY”.</p> <p>2.13.2 The inner and outer envelopes shall</p> <p>(a) be addressed to the Owner at the address indicated in the bidding document;</p> <p>2.13.3 If any of the envelope is not sealed and marked as above, the Owner will assume no responsibility for the misplacement or premature opening of the Bid.</p>
<p>2.14 Deadline for Submission of Bids</p>	<p>2.14.1 Bids shall be delivered to the Owner at the address specified above no later than the time and date specified in the bidding document or notified separately.</p> <p>2.14.2 The Owner may extend the deadline for submission of bids by issuing an amendment, in which case all rights and obligations</p>

	of the Owner and the bidders previously subject to the original deadline will then be subject to the new deadline.
2.15 Late Bids	2.15.1 Any Bid received by the Owner after the deadline prescribed in bidding document may be returned unopened to the Bidder on demand or disposed of as deemed fit, in absence of such a demand within 30 days. Bidder is requested to mention the name and address of the bidder on this envelop so that the unopened bid can be posted.

E. Bid Opening and Evaluation

2.16 Bid Opening	<p>2.16.1 The Owner will open all bids on the date at the place specified in the bidding document. Only the Technical Bids provided in a separate envelop inside the bid shall be opened for technical evaluation at this stage.</p> <p>2.16.2 The Price Bids shall be kept sealed till later stage.</p>
2.17 Process to be Confidential	<p>2.17.1 Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process. The details on the methodology of evaluation and the results of evaluation shall not be declared to any bidder.</p> <p>2.17.2 Any effort by a Bidder to influence the Owner/Owner's Management regarding RFP, processing of bids or award decisions may result in the rejection of his Bid.</p>
2.18 Clarification of Bids	<p>2.18.1 To assist in the examination, evaluation, and comparison of bids, the Owner may, at the Owner's discretion, ask any Bidder for clarification of the Bidder's Bid, including breakup of the prices, and other information that the Owner may require. The request for clarification and the response shall be in writing or by mail, or fax. In routine no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Owner in the evaluation of the bids.</p> <p>2.18.2 No Bidder shall contact the Owner on any matter relating to its bid from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Owner, it should do so in writing through email.</p>
2.19 Examination of Bids and Determination of Responsiveness	<p>2.19.1 Prior to the detailed evaluation of bids, the Owner will determine whether each Bid (a) has been properly signed; (b) is accompanied by the required security; and (c) is substantially responsive to the requirements of the bidding documents and is generally in order.</p> <p>2.19.2 A substantially responsive Bid is one which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A</p>

	<p>material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Services; (b) which limits in any substantial way, or is inconsistent with the bidding documents, the Owner's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids</p> <p>2.19.3 If a Bid is not substantially responsive, it will be rejected by the Owner, and may not subsequently be allowed to be made responsive by correction or withdrawal of the nonconforming deviation or reservation.</p>
<p>2.20 Correction of Errors</p>	<p>2.20.1 Bids determined to be substantially responsive will be checked by the Owner for any arithmetic errors. Arithmetical errors will be rectified by the Owner on the following basis: if there is a discrepancy between unit prices and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail, and the total price shall be corrected; if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; if there is a discrepancy between the amounts in figures and in words, the amount in words will prevail. Such rectification will be informed to the participating Bidder.</p> <p>2.20.2 The amount stated in the Bid will be rectified by the Owner in accordance with the above procedure for the correction of errors and, with the written concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount as rectified by Owner, the Bid will be rejected, and the Bid Security may be forfeited.</p> <p>2.20.3 The Owner may waive any minor infirmity, nonconformity or irregularity in a bid that does not constitute a material deviation, whether or not identified by the Bidder in Attachment to its bid, and that does not prejudice or affect the relative ranking of any Bidder as a result of the Evaluation.</p> <p>2.20.4 Critical Provisions</p> <p>No deviation, whatsoever, is permitted by the Owner to the provisions relating to the clauses indicated in Attachment regarding Acceptance of all Conditions except for the deviations statement. Bidders are required to furnish a certificate in Attachment indicating their compliance to all the conditions.</p> <p>2.20.5 At the time of evaluation of Bid, the bidder shall withdraw the deviations which are not accepted by Owner. In case the bidder does not withdraw the deviations not accepted by Owner, if any, its bid will be rejected and security deposit forfeited.</p>

2.21 Evaluation and Comparison of Bids	<p>2.21.1 The Owner may evaluate and compare only the bids determined to be substantially responsive in accordance with bidding documents. Technical evaluation criteria as indicated in the document will be used for evaluation.</p> <p>2.21.2 In evaluating the bids, the Owner will determine for each Bid the evaluated Bid price by adjusting the Bid price for making any correction for errors and/or as per criteria mentioned in section 2.25.</p> <p>2.21.3 The Owner reserves the right to accept or reject any variation or deviation.</p>
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F. Award of Contract

2.22 Technical Responsive Criteria of Bids				
	SN	Compliance Criteria	Compliance Requirement	Provided (Yes /No)
	1.	Bid security in separate sealed envelope	Shall provide	
	2.	Price Bid in a separate sealed envelope	Shall provide	
	3.	Technical Bid in a separate sealed envelope with following attachments	Shall provide	
	4.1	List of Tools & Tackles and Software for O&M Predictive/ preventive Maintenance (PM) & Analysis in RFP format	Shall provide	
	4.2.	List of Sub-Contractors proposed by the Bidder in RFP format	Shall provide	
	4.3.	Takeover Plan, with a detailed Organogram and the details of qualification & experience of key personnel.	Shall provide	
	4.4.	Deviations (if any) in RFP format	Shall provide	
	4.5.	Certificate regarding acceptance of important conditions in RFP format	Shall provide	
4.6.	Guarantees in the prescribed format	Shall provide		
<p>*Note: Bids shall be evaluated on the technical responsiveness criteria outlined in the above table. Any bidder failing to meet each of the above criteria will become non-responsive and the bid will not be considered for further evaluation. The Contract may be considered to be awarded to the lowest evaluated responsive bidder as per Price Schedule & NPV calculations, however, GNAL may exercise its own discretion. The decision by the GNAL Management shall be final.</p>				

2.23 Award Criteria	2.23.1 The Owner will award the Contract to the Bidder whose Bid has been found the most suitable to the Owner.
2.24 Owner's Right to Accept Any Bid and to Reject Any or All Bids	2.24.1 The Owner reserves the right to accept or reject any Bid, and to cancel the bidding process and reject all bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Owner's action.
2.25 Competitive bidding evaluation Process	<p>2.25.1 GNAL may use 'merit' based evaluation of the technical offer wherein the bidders may be given merit points, which may result into price loading on the bidders who are having lower merit points as compared to the bidder with the highest merit points. The criteria for allocating such merit points to the bids, based on bid evaluation process, shall be determined by GNAL and the details of the same may not be revealed to the bidders. The decision of GNAL shall be final in this matter.</p> <p>-</p> <p>2.25.2 GNAL shall consider such selection of the 'most competitive bid' through a process of 'Reverse Auction' (RA), in which case it would be mandatory for all the bidders to participate in the RA. The remote participation in RA shall be facilitated with an access / guidance provided by GNAL team. The procedures for participation in RA shall be communicated separately at appropriate time, at least 48 hours prior to conducting the RA. If there are any deviations taken by the bidder which may call for 'loading' on their prices or if there are lower merit points for a bidder resulting into 'loading' on their prices, the same shall be taken into account in the RA process. The prices quoted by those bidders in RA process shall be automatically inflated to the extent of such 'loadings', details of which would be shared with the concerned bidder prior to RA.</p> <p>2.25.3 Having been selected as 'the most competitive bidder' in RA or 'competitive bidding process' conducted through physical presence of the bidders shall not automatically qualify the bidder for the award of the job. GNAL reserves its right to discuss/negotiate further with such a bidder or with other bidders and award the contract to any of such bidders at its sole discretion. However, as a broad criterion, 'the most competitive bidder' shall have first right of refusal to any counter offer that GNAL decides to make.</p>
2.26 Notification of Award and Signing of Agreement	2.26.1 The Bidder whose Bid has been accepted will be notified of the award by the Owner prior to expiration of the Bid validity period by mail or a Letter of Intent. This letter (hereinafter and in the Conditions of Contract called the "Letter of Intent (LOI)") will state the Contract price payable to the O&M Operator in consideration of supply and services as prescribed in the Contract to be signed.

	<p>LOI will be issued in two copies to successful Bidder and Bidder shall return one copy of said LOI duly signed to Owner</p> <p>2.26.2 The notification of award will constitute the formation of the Contract.</p> <p>2.26.3 The Contract, with all the detailed terms and conditions, will incorporate all agreements between the Owner and the successful Bidder. The detailed contract, drawn later, may contain certain additional but relevant provisions which may have been inadvertently left out in earlier communications / discussions with the bidder during the bidding and selection processes. The Contract will be signed jointly by the Owner and successful Bidder along with the attachments within 15 days of receipt of the LOI. The successful bidder shall sign the Contract together with the required Performance Security. Some of the performance criteria in the contract may be determined subsequent to the Guarantee Test Run of the plant. In such case, these criteria, forming an integral part of the contract, shall be signed later as an 'supplement' to the Contract.</p> <p>2.26.4 The Owner will notify the name of successful Bidder to other bidders, either through individual communication or by publishing on its Web-site and return bid security to them.</p> <p>2.26.5 In case, the successful Bidder doesn't sign the Contract within the stipulated timeline or furnish the performance security, then the Owner will invite the next eligible bidder for commercial negotiation. As an alternative, the Owner reserves the right to re-bid the process.</p>
<p>2.26 Performance Security</p>	<p>2.26.1 Within 15(Fifteen) bank's working days after receipt of the Letter of Intent/ or as specified by the Owner the successful Bidder shall submit the Owner a Performance Security in prescribed form of a Bank Guarantee for an amount stipulated in the para 4.6.2.</p> <p>2.26.2 Failure of the successful Bidder to comply with the requirements of bidding document shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.</p>
<p>2.27 Advance Payment</p>	<p>2.27.1 The Owner will make an Advance Payment of 10% of the Annual Contract Price as stated in the bidding document (Para 5.36).</p>
<p>2.28 Notice to Proceed</p>	<p>2.28.1 After receipt of Performance Security and as per the estimation, the Owner will issue NTP (Notice to Proceed) along with an advance.</p>

2.29 Effective Date	2.29.1 Effective Date will be the date on which the Owner makes the advance payment to the O & M operator. However, O & M operator shall submit the requisite documents for making advance payments not later than 15 days from receipt of LOI.
2.30 Labour Laws	<ul style="list-style-type: none"> <li data-bbox="505 338 1458 479">a. The Bidder shall furnish valid Employee Provident Fund (EPF) code number, Professional tax registration together with supporting relevant document duly notarized by notary public to this effect along with Performance Security. <li data-bbox="505 479 1458 696">b. The successful Bidder shall obtain license under Contract Labor (R&A) Act 1970 read with rules framed thereunder and furnish the same to GNAL within 30 (Thirty) days from the acceptance of Award of Contract failing which the Award of Contract may be cancelled / terminated without any further notice and their Bid Security may be forfeited. <li data-bbox="505 696 1458 775">c. The Bidder shall ensure that he complies with all labour laws including payment of minimum wages. <li data-bbox="505 775 1458 880">d. Owner shall provide the necessary documentation support like Form 5 for issuance of labor license to Successful bidder and its subcontractors

CHAPTER 3

3. Bid Data Sheets (BDS)

The following bid specific data for the Plant to be operated and maintained shall amend and/or supplement the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in the ITB. It is clearly understood and agreed that the selected O&M Operator shall achieve good performance of GNAL Caustic Soda Plant at Plot D-2/9 Dahej Industrial Estate, Dist Bharuch as mentioned in attachment 7 of Guarantees referred in para 2.7 above. It is also clearly understood and agreed that the selected O&M Operator/Contractor/ shall carry out all activities related with complete O&M of GNAL Caustic Soda Plant at Plot D-2/9 Dahej Industrial Estate, Dist. Bharuch for a period of 5(Five) years from the date of takeover after the GTR.

A. INTRODUCTION

3.1. Names & Address of Caustic Soda Plant:

800 TPD Caustic Soda Plant,
Plot D-2/9, Dahej Industrial Estate, Village Rahiyad, Taluka Vagra,
District Bharuch, Gujarat, India

B. THE BIDDING DOCUMENTS

3.2. Communication Address of Owner:

Head CS Plant
GACL-NALCO Alkalies & Chemicals Pvt. Limited
401-403, Yashkamal Building, Sayajigunj.
Vadodara – 390020, Gujarat.
Samit.panchal@gnal.co.in
Thomas.Varughese@gnal.co.in

3.4 Pre-Bid Meeting:

The Bidder or his authorized representative (maximum two persons) is invited to attend pre-bid meeting which will take place at the following address:

GACL-NALCO Alkalies and Chemicals Private Limited
401-403, Yashkamal Building,
Sayajigunj, Vadodara – 391346 (Gujarat)

A fresh pre-bid meeting is scheduled on **Aug. 12, 2020 at 1430 hours**. The purpose of the meeting is to clarify all issues regarding the Bidding Documents. In order to avoid any deviations in the bid to be submitted, the Bidders are encouraged and requested to submit all their doubts and questions by E-Mail to reach the Owner as soon as possible. Based on the clarifications given the Owner may modify the Bid document through an amendment and not through the record notes of the pre-bid meeting. The Bidders will be informed about the modified bid-documents through email. Non-attendance at the pre-bid meeting will not be a case for disqualification of a Bidder.

C. PREPARATION OF BIDS

3.5 Qualification Requirements for Bidders:

Only the Bidders qualified by the assessment of GNAL are eligible to bid against this RFP.

Validity of Bid: **Until four months of due date for submission of Price bid.**

D. SUBMISSION OF BIDS

3.6 Refundable Bid Security: Rs. 10,00,000/-in the form of Bank Demand Draft (DD) or Bank Guarantee in prescribed format favoring 'GACL-NALCO Alkalies and Chemicals Private Limited' payable at Vadodara to be submitted along with the bid. Bid Security of all unsuccessful bidders will be refunded after receipt of Performance Security from appointed O&M Operator.

3.7 Address for Submission of Bid & Bid Security:

Head CS Plant
GACL-NALCO Alkalies and Chemicals Private Limited
401-403, Yashkamal Building,
Sayajigunj, Vadodara – 391346 (Gujarat)

3.8 UNPRICED/Technical Bid including commercial terms and condition
Due Date & Time: **17 Aug. 2020, 4:00 PM**

3.9 PRICE BID Due Date & Time: To be determined

E. BID OPENING AND EVALUATION

3.9 Location of Bid Opening:

GACL-NALCO Alkalies and Chemicals Private Limited
401-403, Yashkamal Building,
Sayajigunj, Vadodara 391346 Gujarat, India

Date of Technical Bid Opening: **18 Aug 2020**

Time of Technical Bid Opening: **04:00 PM**

Date of Price Bid Opening: (will be communicated at the earliest)

Time of Price Bid Opening: (will be communicated at the earliest)

For Reverse Auction Process, the 'Price Bids' shall be opened a few hours prior to the scheduled time of Reverse Auction.

3.10 Currency chosen for the purpose of evaluation: **Indian Rupees (INR)**

F. Takeover of Caustic Soda Plant

3.11 Time Period for Bidder to accept letter of Intent & submit Performance Guarantee: Within 07 Days from issue of Letter of Intent

- 3.12 Time Period in which Owner makes an advance payment to the appointed O&M Operator: Within 15 Days from receipt of advance Bank Guarantee in a prescribed format, invoice and other relevant documents specified in para 5.36.
- 3.13 Time Period in which appointed O&M Operator reports to site for commissioning support: Within 15 Days of receipt of an advance payment & Notice to Proceed. The deployment of manpower during pre-commissioning period would be progressive, as requisitioned by the Owner
- 3.15 Time Period during which Guarantees, Penalties & Incentives shall be applicable: 360 days from the date of take-over of the plant by the O&M Operator or as mutually agreed otherwise.

Chapter 4

4. General Conditions of Contract (GCC)

4.1 Contract Documents

- 4.1.1 All documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as the document as a whole.
- 4.1.2 The Contract will be signed in two originals and the Contractor shall be provided with one signed original and the one will be retained by the Owner.

4.2 Interpretation

4.2.1 Language

All Contract Documents, all correspondence and communications to be given, and all other documentation to be prepared and supplied under the Contract shall be written in English and the Contract shall be construed and interpreted in accordance with that language.

4.2.2 Singular and Plural

The singular shall include the plural and the plural the singular, except where the context otherwise requires.

4.2.3 Headings

The headings and marginal notes in the General Conditions of Contract are included for ease of reference and shall neither constitute a part of the Contract nor affect its interpretation.

4.2.4 Persons

Words importing persons or parties shall include firms, corporations and government entities.

4.2.5 Construction of the Contract

The Contract to be entered into between the Owner and the O&M Contractor shall comprise of all the relevant terms and conditions as mentioned in RFP and other terms and condition as may be mutually agreed subsequently.

4.2.6 Entire Agreement

The Contract constitutes the entire agreement between the Owner and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract.

4.2.7 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.

4.2.8 Independent Contractor

The Contractor shall be an independent Contractor performing the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the parties hereto.

Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives

or Sub-Contractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not have any right whatsoever of employment with the Owner or be deemed to be employees of the Owner, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives or Sub-Contractors and the Owner. The Contractor is responsible for arranging all statutory permissions including but not limited to all Labor licenses, IBR, Weights and measures etc., and the Owner shall have no liability or obligation whatsoever in this regard.

4.2.9 Non-Waiver

4.2.9.1 No relaxation, forbearance, delay or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect or restrict the rights of that party under the Contract, nor shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

4.2.9.2 Any waiver of a party's rights, powers or remedies under the Contract must be in writing, must be dated and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

4.2.10 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

4.2.11 Third Party Rights

Nothing in this Contract is intended to confer any rights / remedies under or by reason of this Contract on any third party.

4.3 Notices

4.3.1 Unless otherwise stated in the Contract, all notices to be given under the Contract shall be in writing, and shall be sent by Registered post or E-Mail to the address of the relevant party set out in the Contract Coordination Procedure.

4.3.2 Any notice sent by E-Mail shall be valid if it is acknowledged by the receiving party. The Party sending any notice by Email should approach the receiving party to check whether email is received by the other Party or not.

4.3.3 Any notice sent by post or special courier shall be deemed (in the absence of evidence of earlier receipt) to have been delivered ten (10) days after dispatch. In proving the fact of dispatch, it shall be sufficient to show that the envelope containing such notice was properly addressed, stamped and conveyed to the postal authorities or courier service for transmission by airmail or special courier.

4.3.4 Either party may change its postal address, E-Mail address and addressee for receipt of such notices by ten (10) days' notice to the other party in writing.

4.3.5 Notices shall be deemed to include any approvals, consents, instructions, orders and certificates to be given under the Contract.

4.4 Governing Law

4.4.1 The Contract shall be governed by and interpreted in accordance with laws in force in India. The Courts of Vadodara (India) shall have exclusive jurisdiction in all matters arising under the Contract.

4.5 Settlement of Disputes

4.5.1 Adjudicator Disputes

4.5.1.1 If any dispute of any kind whatsoever shall arise between the Owner and the Contractor in connection with or arising out of the Contract—the Parties shall seek to resolve any such dispute or difference by mutual consultation. If the Parties fail to resolve such a dispute or difference by mutual consultation, then the dispute shall be referred in writing by either Party to the Adjudicator, with a copy to the other Party.

4.5.1.2 The Adjudicator shall give its decision in writing to both Parties within twenty-eight (28) days of a dispute being referred to it. If the Adjudicator has done so, and no notice of intention to commence arbitration has been given by either the Owner or the Contractor within fifty-six (56) days of such reference, the decision shall become final and binding upon the Owner and the Contractor. Any decision that has become final and binding shall be implemented by the Parties forthwith.

4.5.1.3 Should the Adjudicator resign or die, or should the Owner and the Contractor agree that the Adjudicator is not fulfilling its functions in accordance with the provisions of the Contract, another retired Judge of High Court / Supreme Court of India shall be jointly appointed by the Owner and the Contractor as Adjudicator under the Contract. Failing agreement between the two within twenty-eight (28) days, the new retired Judge of High Court / Supreme Court of India shall be appointed as Adjudicator under the Contract on the request of either Party by the Appointing Authority specified in the SCC. The Adjudicator shall be paid fee plus reasonable expenditures incurred in the execution of its duties as Adjudicator under the Contract. These costs shall be divided equally between the Owner and the Contractor.

4.5.2 Arbitration

4.5.2.1 If either the Owner or the Contractor is dissatisfied with the Adjudicator's decision, or if the Adjudicator fails to give a decision within twenty-eight (28) days of a dispute being referred to it, then either the Owner or the Contractor may, within fifty-six (56) days of such reference, give notice to the other Party, with a copy for information to the Adjudicator, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given.

4.5.2.2 Any dispute in respect of which a notice of intention to commence arbitration has been given shall be finally settled by arbitration.

4.5.2.3 Any dispute submitted by a Party to arbitration shall be heard by an arbitration panel composed of three arbitrators, in accordance with the provisions set forth below.

4.5.2.4 The Owner and the Contractor shall each appoint one arbitrator, and these two arbitrators shall jointly appoint a third arbitrator, who shall chair the arbitration panel. If the two arbitrators do not succeed in appointing a third arbitrator within twenty-eight (28) days after the latter of the two arbitrators has been appointed, the third arbitrator shall, at the request of either Party, be appointed by the Appointing Authority for arbitrator as provided under the Arbitration Act.

- 4.5.2.5 If one party fails to appoint its arbitrator within forty-two (42) days after the other Party has named its arbitrator, the Party which has named an arbitrator may request the Appointing Authority to appoint the second arbitrator.
- 4.5.2.6 If for any reason an arbitrator is unable to perform its function, the mandate of the Arbitrator shall terminate in accordance with the provisions of applicable laws and a substitute shall be appointed in the same manner as the original arbitrator.
- 4.5.2.7 Arbitration proceedings shall be conducted (i) in accordance with the rules of procedure designated in the SCC, (ii) in the place designated in the SCC, and (iii) in the language in which this Contract has been executed.
- 4.5.2.8 The decision of a majority of the arbitrators (or of the third arbitrator chairing the arbitration panel, if there is no such majority) shall be final and binding and shall be enforceable in any court of competent jurisdiction as decree of the court. The parties thereby waive any objections to or claims of immunity from such enforcement.
- 4.5.2.9 The arbitrator(s) shall give reasoned award.
- 4.5.3 Notwithstanding any reference to the Adjudicator or arbitration herein,
- (a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree
 - (b) the Owner shall pay the Contractor any payments due to the Contractor.

4.6 Security

4.6.1 Issuance of Security

The O&M Operator shall provide the following performance securities for the due and faithful performance of its obligations under the Contract in the amount, manner and form specified below.

4.6.2 Contract Performance Security

- 4.6.2.1 Within 15 (fifteen) days from the date of LOI, the O&M Operator, shall, provide security for due and faithful performance of its obligations under the Contract for a value equivalent to **ten percent (10%) of the first year O&M Fees** in the form of an unconditional and irrevocable bank guarantee in the prescribed format ("**Contract Performance Security**") with an **initial validity of 1 (one) year and a further claim period of 3 (three) months thereafter.**
- 4.6.2.2 The Contract Performance Security shall be renewed every year throughout the term of the Contract, at least **90 (ninety) days prior to its expiry.**
- 4.6.2.3 The value of guarantee shall be adjusted in line the O &M charges for relevant year.

4.7 Copyright and Intellectual Property Right (IPR) and NDA

The copyright of material containing data and information furnished by the Owner to the Contractor shall remain with the Owner. The bidder shall sign the Non-disclosure agreement (NDA) with the Owner to protect Copyright and Intellectual Property Right (IPR) and commercial information shared in good faith.

4.8 Confidential Information

- 4.8.1 The Contractor shall keep information confidential and shall not, without the written consent of the Owner, divulge to any third party any documents, data or other information furnished directly or indirectly.

- 4.8.2 The Owner shall not use such documents, data and other information received from the Contractor for any purpose other than execution of the Contract and operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data and other information received from the Owner for any purpose other than the operation and maintenance of the CS Plant as required for the performance of the Contract.
- 4.8.3 The obligation of a Party under GCC Sub-Clauses above, however, shall not apply to that information which
- (a) now or hereafter enters the public domain through no fault of that party.
 - (b) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto.
 - (c) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.
 - (d) is required to be disclosed by Governmental or judicial order, in which case the party so required shall give the other party prompt notice, where possible and use reasonable effort to ensure that such disclosure is accorded confidential treatment and also to enable such other party to seek a protective order or other appropriate remedy at such other party's sole costs.
- 4.8.4 The above provisions of this GCC Clause shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.
- 4.8.5 The provisions of this GCC Clause shall survive termination, for whatever reason, of the Contract.

4.9 Representatives

4.9.1 Owner's Representative

The Owner shall appoint and notify the Contractor in writing of the name of the Owner's Representative. The Owner's Representative shall represent and act on behalf of the Owner at all times during the execution of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Owner's Representative. All notices, instructions, information and other communications given by the Contractor to the Owner under the Contract shall be given to the Owner's Representative.

4.9.2 Contractor's Representative/s

- 4.9.2.1 The Contractor shall appoint the Contractor's Representative/s and shall request the Owner in writing along with CV of representative/s to approve the person so appointed. If the Owner makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved.
- 4.9.2.2 If the Owner objects to the appointment within fourteen (14) days giving the reason there of, then the Contractor shall submit to the Owner the CV of a replacement, within fourteen (14) days of such objection and the procedure for approval by the Owner laid down under Clauses 4.9.2.1 and 4.9.2.2 shall apply *mutatis mutandis*.
- 4.9.2.3 The Contractor's Representative shall represent and act for the Contractor at all times during the execution of the Contract and shall give to the Owner's

representative all the Contractor's notices, instructions, information and all other communications under the Contract.

4.10 Limitation of Liability

4.10.1 Notwithstanding any other provisions, except in cases of Gross Negligence, criminal negligence or Willful Misconduct, neither the Contractor nor the Owner shall be liable to the other, whether in Contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs.

4.10.2 Except as expressly specified in the Contract, the aggregate liability of the Contractor, on an annual basis, for any damages, claims, losses, demands, costs and expenses (including liquidated damages but excluding those related to violation of safety and housekeeping obligations provided under Section 6.5 and 6.7) under the Contract, shall not exceed 10% of the aggregated O&M Fee of that particular year.

4.11 Loss or Damage to Property; Accident or Injury to Workers Indemnification

4.11.1 The Contractor shall indemnify and hold harmless the Owner and its employees and officers from and against any and or administrative proceedings, claims, demands, losses, all suits, actions damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property, arising in connection with the performance by the O&M Operator of its obligations under the Contract and by reason of the negligence of the Contractor or its Sub-Contractors, or their employees, officers or agents.

4.11.2 No indemnity or hold harmless provision of this Contract shall apply if loss or damage to any property, or injury to or death of persons, is due to Gross Negligence or Willful Misconduct of the Owner.

4.12 Change in Laws and Regulations

4.12.1 After the issuance of LOI, irrespective of change in Law and regulations, the O &M Fees shall remain firm throughout the duration of the contract.

4.13 Force Majeure

4.13.1 "**Force Majeure**" shall mean any event beyond the reasonable control of the Owner or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the Party affected.

4.13.2 If either Party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within seven (7) days after the occurrence of such event.

4.13.3 The Party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such Party's performance is prevented, hindered or delayed.

4.13.4 Force Majeure Events

A '**Force Majeure Event**' means any of the following, or a combination of them, occurring in India:

- (a) to the extent that it could not reasonably have been expected to occur at the place or at the time of year after taking into account meteorological

data available at the Meteorological Department of India, cyclone, whirlwind, flood, tempest, storm, drought or other exceptionally adverse weather conditions (excluding normal monsoon conditions);

- (b) a natural act or epidemic, lightning, earthquake, volcanic eruption, meteorite, air crash, objects falling from aircraft, pressure waves caused by aircraft or aerial devices travelling at supersonic speed or, where it originates from a source external to the Site, a landslide, fire or explosion;
- (c) to the extent that it involves India but originates from a source external to India, act of war (whether declared or undeclared) invasion, armed conflict or action of foreign enemy, blockade, embargo, revolution, riot, insurrection, terrorist or military action, civil commotion or politically motivated sabotage, chemical, biological or radioactive contamination or ionising radiation or any natural act affecting communication and transportation links to India;
- (d) to the extent they occur in India, strikes or industrial action that interrupt supplies and services to the Facility (Caustic Soda Plant) or the operation of the Facility (Caustic Soda Plant) for at least seven (7) continuous days and which:
 - (i) are not India Political Events;
 - (ii) do not primarily involve the Owner, the Owner's contractors, the fuel supplier, or their respective employees, agents or representatives; or
 - (iii) are not attributable to any discriminatory policy or practice of the Owner, the Owner's contractors, the fuel supplier or their respective employees, agents or representatives; or
- (e) Any similar event or circumstance.

4.13.4 If and when the operation of the plant is required to be completely stopped for the reason of non-supply of raw materials and/or utilities, the O & M operator will not be responsible for such stoppage and the plant shall be re-started by the O & M Operator at the earliest possible in consultation with the owner. The O & M operator will not be liable for any consequential losses, damage or other liabilities, which may be suffered by or arise to the owner during period of such stoppage.

4.13.5 If the operation of the Plant has been stopped because of strike, protest or labour disturbance by the employees of the O & M operator and/ or O & M operator's authorised representative (s), then it shall be solely responsible for the same and consequences thereof.

4.13.6 Allocation of costs arising due to Force Majeure

During subsistence of a Force Majeure Event, the Owner and the Contractor shall bear their respective costs and neither Party shall be required to pay to the other Party any costs or O&M Fees.

4.13.7 Termination due to Force Majeure

If a Force Majeure Event subsists for a period of [180 (one hundred and eighty) days or more within a continuous period of 365 (three hundred and sixty five) days], either Party may in its discretion terminate the Contract by issuing a termination notice to the other Party without being liable in any manner whatsoever, and upon issue of such termination notice, the Contract shall stand terminated forthwith;

provided that before issuing such termination notice, the Party intending to issue the termination notice shall inform the other Party of such intention and grant 15 (fifteen) days' time to make a representation, and may after the expiry of such 15 (fifteen) days, whether or not it is in receipt of such representation, issue the termination notice.

4.14 Termination

The Owner shall without prejudice to any of its rights and remedies under the Contract or in law or in equity terminate the Contract or part thereof as mentioned below.

4.14.1 Termination for Contractor's Default

4.14.1.1 The Owner, without prejudice to any other rights or remedies, it may possess, may terminate the Contract forthwith by giving a notice of termination to the Contractor upon happening of any of the following event:

- (a) if the Contractor becomes bankrupt or insolvent, a receiver is appointed, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt.
- (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the Contract.
- (c) if the Contractor, in the judgment of the Owner has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.
- (d) If the Contractor has abandoned the Contract.

4.14.1.2 The Owner, without prejudice to any other rights or remedies, it may possess, may terminate the Contract by giving a notice of termination and its reasons thereof to the Contractor after giving a reasonable notice of cure for such breach by the Contractor for 60 (sixty) days upon happening of any of the following event:

- (a) If the Contractor has without valid reason failed to commence work on the Facilities promptly or has suspended the progress of Contract performance for more than seven (7) days after receiving a written instruction from the Owner to proceed.
- (b) If the Contractor persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause.
- (c) If the Contractor refuses or is unable to provide sufficient materials, services or labor to execute the Contract.
- (d) If the Contractor enters into a contract with the Owner's employee in connection with which commission has been paid or agreed to be paid by it, unless the particulars of any such commission and the terms of the payment thereof have been disclosed, in writing to the Owner and approval have been sought of the Owner prior to the execution of such contract by the Contractor.
- (e) If the Contractor has failed to deliver services in part or full, then the Owner may, by notice to the Contractor and without prejudice to any other remedy under the Contract, terminate the Contract but without thereby releasing the

Contractor from any of its obligations or liabilities which have accrued as at the date of termination of the contract and without affecting the rights and powers conferred by the Contract on the owner. Upon such termination the owner may itself complete the supplies or may employ any other Contractor to complete the job at the risk and cost of the Contractor.

- (f) If the contractor is unable to replace/ recruit new key staff member/s within a period of four weeks in case the existing staff failed to perform to the satisfaction of the Owner, who had asked for a replacement.
- (g) If the contractor is unable to replace/ recruit new key staff member/s within a period of four weeks in case the existing staff leaves.

4.14.2. Termination without Contractor's default

The Owner reserves the right to terminate the Contract at any time without assigning any reason, by giving six months' notice. The Contractor shall stop the performance of the Contract from the effective date of termination of the Contract as mentioned in the notice of termination and shall hand over all drawings, documents, spares, tools and tackles, the rights to the software provided by the O&M Contractor during the Term including related rights, sanctions and approvals to the Owner and shall demobilize from the Site as mentioned in the Contract. Owner shall pay to the Contractor the O&M Fees due to the Contractor till the date of termination, duly supported by documents, after adjusting payments already made till the termination. No consequential damages shall be payable by the Owner to the Contractor in the event of such termination.

4.14.3 Termination for Owner's Default

4.14.3.1 If the Owner has failed to pay the Contractor any undisputed sum due under the Contract within the period required as per the O&M Contract or has failed to approve any invoice or supporting documents without just cause, the Contractor shall give a notice of 60 (sixty days) days for remedy of such failure by the Owner.

4.14.3.2 The Contractor shall issue a notice to the Owner with a further 15 (fifteen) days of cure period and terminate the Contract if the Owner fails act as per Clause 4.14.3.1 above.

4.14.4 Contractor to continue the performance

Notwithstanding the issue of a termination notice by either Party, the Contractor shall continue to perform its obligations under the Contract with the objective of ensuring continued availability of the Facilities, failing which the Contractor shall compensate the Owner for any loss or damage occasioned or suffered on account of the underlying failure or breach.

4.14.5 Handover of Facilities

Upon termination of the Contract, howsoever caused, the Contractor shall cooperate with Owner and any successor O&M Contractor appointed by the Owner for the peaceful handing over of the Facilities. All rights and obligations of the Contractor under the Contract shall be ceased except under the Clauses which expressly requires survival after the termination. The Contractor shall comply with all reasonable requests of the Owner in this regard including the execution of documents and other actions.

4.14.6 Suspension

4.14.6.1 The Owner may suspend work in whole or in part at any time giving contractor notice in writing to such effect stating the nature, the date and the anticipated duration of such suspension. On receiving the notice of suspension, the contractor shall stop all such work, which the owner has directed to be suspended with immediate effect after taking all due precautions and following the stoppage procedures. The contractor shall however continue to perform other work in terms of the contract, that the owner has not suspended. Contractor shall resume the suspended work as expeditiously as possible after receipt of the withdrawal of suspension notice.

4.14.6.2 In case the suspension continues for more than 240 days (two hundred and forty), at the end of the said period, the contractor shall by a further 30 (thirty) days prior notice to the Owner, be entitled to terminate the Contract. In that case the Contractor shall hand over all materials, spares, consumables, drawings, documents and all goods manufactured by him including related rights, all software installed, sanctions and approvals to the Owner. However, if the Owner permits the Contractor to resume work within the 30 day period, the Contractor will not have any rights of termination due to such suspension.

4.14.6.3 The Owner shall pay the Contractor the actual cost incurred by the contractor from the date of suspension till the date of the termination or the date of resumption of the work as applicable, duly supported by documents provided by the Contractor, after adjusting payments till such suspension.

4.15 Adjudicator:

Adjudicator under the contract shall be a retired Judge of High Court / Supreme Court of India as may be jointly appointed by MD/CEO, GNAL & MD/CEO of an O&M Operator.

4.16 Settlement of Disputes

The arbitration proceedings shall be conducted in accordance with Indian Arbitration and Conciliation Act 1996.

The Place for Arbitration shall be: **Vadodara, India.**

4.17 General Obligations of the O&M Operator

4.17.1 The O&M Operator shall ensure that the O&M Services are, at all times during the Term, performed:

- (i) in accordance with Prudent Industry Practice;
- (ii) in a manner which is not likely to be injurious to health or likely to cause damage to property;
- (iii) accordance with Law and Environmental Standards;
- (iv) in accordance with all Relevant Consents;
- (v) having full regard to the safety of all persons on the Site;
- (vi) so as to ensure that the Site and the Facility is kept in an orderly state, in accordance with Prudent Industry Practice; and
- (vii) in compliance with all conditions and restrictions relating to the Site as prescribed by the Owner from time to time.

4.18 Quality Assurance

The O&M Operator shall ensure that the operation and maintenance of the CS Plant is subject to quality management systems which shall comply with Prudent Industry Practices and Environment Standards.

The Owner may carry out audits of the O&M Operator's quality management systems from time to time including periodic monitoring and spot checks.

The O&M Operator shall co-operate with the Owner in providing such information and documentation which the Owner may reasonably require in connection with the Owner's rights of inspection under this clause.

4.19 Representations and Warranties

4.19.1 Each Party makes the following representations and warranties to the other Party.

- a. Incorporation, power and capacity
It is duly incorporated under the Laws of India and has the power and capacity to enter into the Contract and perform its obligations under the Contract.
- b. Authorization
It has taken all necessary action to authorize entry into and comply with its obligations under this Agreement.
- c. Binding obligations
It has taken all necessary action to ensure that its obligations under the Contract are legal, valid, binding and enforceable in accordance with its terms.

4.19.2 Without prejudice to the generality of the foregoing, the Contractor hereby makes the following representations and warranties to the Owner and acknowledges that the Owner has relied on such representations and warranties in entering into the Contract

- (a) Operation of the Facility
The Contractor warrants that the Facilities shall be operated in accordance with the performance guarantees stipulated under Chapter 6 for the duration of the Operating Tenure.
- (b) Status of Site
The Contractor warrants that the Site and the Facility will be kept in an orderly state, in accordance with Prudent Industry Practice and the Contractor shall observe all conditions and restrictions relating to the Site.
- (c) Information and records
All information and records disclosed by the Contractor to the Owner arising out of or in relation to the performance of the Contract, including in response to the RFP issued by the Owner, are true, accurate, complete and not misleading in any material respect.
- (d) Suits and proceedings
There is no action, suit or proceeding, at law or in equity, or official investigation by or before any governmental authority, arbitral tribunal or any other body pending or, to the knowledge of the Contractor threatened, against or affecting the Contractor or any of its properties, rights or assets, which could reasonably be expected to adversely affect, in any manner whatsoever, the Contractor's ability to perform its obligations under this Contract or the validity or enforceability of this Contract.

4.20 Tax

The Parties agree that the fees payable by the Owner to the Contractor for the services provided under the Contract shall be subject to Tax Deduction at Source (TDS) under the Income Tax Act, 1961 and/or other statutory deductions as applicable from time to time.

Chapter 5

5. Special Conditions of Contract (SCC)

The following Special Conditions of Contract (SCC) shall supplement / amend the General Conditions of Contract (GCC). Wherever there is a conflict, the provisions in SCC shall prevail over those in the GCC.

5.1 Work Program

5.1.1 Contractor's Organization

The O&M Operator shall supply to the Owner a chart showing the proposed organization to be established by the Contractor for carrying out work for the pre-commissioning, commissioning and the operation and maintenance of Facilities. The chart shall include the identities of the key personnel (at least up to top 4 levels) together with the curriculum vitae of such key personnel to be employed within 15 (fifteen) days of the receipt of award of Contract. The Contractor shall promptly inform the Owner in writing of any revision or alteration in such an organization chart.

The employees / workmen of the contractor shall be polite, decent, and courteous to all officers /employees/ workmen of GNAL, and shall maintain a high standard of discipline, decency, and decorum. They shall be medically fit and fully competent to perform the work. The upper age limit shall be 60 years, except certain exceptional cases with unique set of qualification and experience, where specific exceptions can be made on case-to-case basis with prior written consent of GNAL. All such appointments shall be subject to review every two years.

5.1.2 Subcontracting

5.1.2.1 The Contractor shall not sub-contract or sub-let the whole or part of the services or the whole of its services under this O&M Contract, whether to one or more parties without permission of the Owner in writing. Further, the Owner reserves its rights to define certain areas/functions wherein sub-contracting or sub-letting shall not be permitted.

Provided however, any sub-contracting of any of its obligations under this Contract by the Contractor shall not in any manner relieve the Contractor of its obligations to the Owner.

5.1.2.2 The Contractor shall ensure that all Sub-Contractors maintain insurance similar to that required to be maintained by the Contractor.

5.1.2.3 In the event the Contractor seeks appoint a Major Sub-Contractor, the Contractor shall ensure that such Sub-Contractor proposed satisfies the following criteria for which documents shall be submitted for the approval of the Owner

- i. The proposed Major Sub-Contractor shall have worked in a similar capacity in a caustic soda plant or similar plant for at least 3 years;

- ii. The proposed Major Sub-contractor must have a sound financial condition and should submit their financial statements/P&L statement/IT returns verified by a practicing chartered accountant for the last three years;
- iii. The proposed Major Sub-Contractor must submit the list of tools and tackles as well as the resume of its main manpower;
- iv. The proposed Major Sub-Contractor must submit the copies of all statutory approvals/permissions to be able to carry out the works;
- v. The proposed Major Sub-Contractor shall submit an affidavit stating his acceptance to following all the rules and regulations prevalent at that point of time.

5.1.2.4 In relation to any Major Sub-Contract

- i. The Owner may require, as a condition to such providing its consent, that any such Major Sub-Contractor enter into a direct agreement with the Owner and/or its lenders/agents or trustees of the lenders of the Owner.
- ii. Un-priced copies of all Major Sub-Contracts shall be submitted to the Owner immediately after signing/ordering of such sub-contracts by the Contractor;
- iii. All Major subcontracts shall expressly permit assignment of all rights and obligations of the Contractor to the owner or its nominee on the issuance of notice in this regard by the Owner to such Major Sub-Contractor.

5.2 Insurance

5.2.1 The Owner shall cater to the insurances with respect to the equipment and the Caustic Soda Plant. This includes the Third Party Liability Insurance, IAR (Industrial All Coverage except the manpower and property of O& M operator the responsibility of which will be always with O &M operators), Machinery breakdown, Fire and the Loss of Profit and Business Interruption Insurance. In case of occurrence of any such eventuality, the O&M Operator must continue to provide performing its obligations under the Contract without waiting for the settlement of any insurance claim and on a best efforts basis, ensure that the CS Plant is restored under normal working condition in short span of time. However, the insurance claims realized pursuant to any such eventuality will be passed on to the O&M Operator by GNAL. The O&M Operator must support GNAL and provide all the necessary documents to the Insurance Company to avail such insurance claim. The list of insurance by the owner provided in Annexure-8.

5.2.1.2 To the extent of any insurance recovery under any insurance policy maintained by the O&M Operator or the Owner, the O&M Operator and the Owner hereby waive any right of recovery against each other. This Clause is intended to constitute a full waiver of the insurers' rights of subrogation. Accordingly, each Party will ensure that insurance companies will not have any right of subrogation against the other Party.

5.2.1.3 The Parties agree that notwithstanding the availability, pendency or otherwise of insurance for and in respect of the Facilities, the O&M of the Facilities shall remain the sole responsibility of the O&M Operator during the Term. The Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall

be subject to the approval of the Owner, who should not unreasonably withhold such approval.

5.2.2 Automobile Liability Insurance

Comprehensive automobile liability insurance Covering use of all vehicles/heavy equipment/ used by the Contractor or its Sub-Contractors covering vehicles owned, hired or non-owned in connection with the execution of the Contract.

5.2.3 Workers' Compensation

In accordance with the statutory requirements applicable, the insurance of the employees involved in this contract on the rolls of the Contractor shall be Contractor's responsibility. This would broadly cover the following

- i) Workers compensation and occupational illness insurance for all the contractors and Sub-Contractors' staff
- ii) Employers liability insurance with adequate limits per occurrence and in the aggregate
- iii) Comprehensive or commercial general liability insurance with bodily injury and property damage subject to deductibles; such insurance shall include but not necessarily limited to contractual liability, property damage liability, personal injury liability, liability for pollution (sudden or accidental), watercraft protection

5.2.4 Other Insurance

Insurance covering Force Majeure, War Risk and such other insurances as may be specifically agreed upon by the parties.

5.2.5 The Contractor shall ensure that, where applicable, its Sub-Contractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Sub-Contractors are covered by the policies taken out by the Contractor.

5.2.6 If the Contractor fails to take out and/or maintain in effect the insurances, the Owner may take out and maintain in effect any such insurances and may from time to time deduct from any amount due to the Contractor under the Contract any premium that the Owner shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor.

5.2.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it, and the premium payable by any insurers shall be paid to the Contractor. The Owner shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Owner's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Owner. With respect to insurance claims in which the Contractor's interest is involved, the Owner shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

- 5.3 Contractor shall have to arrange and procure at their own costs required number of tools, tackles, safety Personnel Protective equipment for workmen engaged and other equipment for execution of the job work.
- 5.4 Contractor shall arrange and obtain License under the provisions of Contract Labour (Regulation & Abolition) Act, 1970 and Rules 1972 thereunder, before deploying the necessary manpower for commencing contract work and submit a copy of the same to GNAL. In absence of such License, the Contract shall be liable to be terminated forthwith without assigning any reasons thereof and liabilities whether legal, statutory or of financial as a result and consequence thereof shall be on the contractor. Contractor shall comply with all the requirements of all labour & industrial laws including *inter alia* Contract Labour (Regulation & Abolition) Act, 1970, Employees' Provident Fund and Miscellaneous Provisions Act, 1952, Employees' State Insurance Act, 1948, Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013, Payment of Gratuity Act, 1972, Maternity Benefit Act, 1961, Rights of Persons with Disabilities Act, 2016, Code on Wages, 2019 and such other Laws as may be applicable to the Contractor ("Labour Laws") in respect of all their employees employed by the contractor in connection with the job work awarded to them. The Contractor shall comply with all the relevant Labour Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights. The Contractor shall require the Contractor's Personnel to comply with all applicable Laws, including those concerning safety at work.
- 5.5 Contractor shall be liable and responsible without any limit notwithstanding anything contained elsewhere, for and shall make good forthwith all losses, damages and expenses incurred or suffered by GNAL and shall keep GNAL harmless and indemnified against all or any claim, injuries, losses suffered or caused to be suffered or incurred by GNAL or by any of the Contractor's employees, workmen, representatives, agents or to all or any of GNAL properties, plant, machinery, equipment's, materials or goods or personnel or to a third party, by reasons or consequence of any act, omission or negligence committed or omitted to be done during the course of their performance of this contract and within the terms of the Contract.
- 5.6 GNAL shall not be liable for all or any claim, injury, loss, damages, cost of expenses which may be made against or caused to be suffered or incurred by contractor, their representatives, employees, workmen, or agents or properties, machinery, equipment, materials or goods during the course of their work under this Contract.
- 5.7 In case of accident, injury, losses caused, suffered or incurred by all or any of Contractor's employees, workmen, representatives or agents, contractor will be wholly and solely responsible to meet with the expenses of accident, treatment and payment of compensation as per the Workmen's Compensation Act.
- 5.8 GNAL shall be entitled to terminate the contract **without compensation and without any notice/reference** to contractor and without prejudice to their right, should the contractor fail to fulfill or carryout all or any of their obligations covered under this contract or commit default or breach of any or all the terms and conditions of this contract.

In case of termination of contract, GNAL shall be entitled to allot the same job to other contractor as it deems appropriate.

- 5.9 Contractor shall forthwith remove or replace any of their employees who in the opinion of GNAL's Officers, is unfit on any account to be associated with the execution of jobs awarded to the contractor.
- 5.10 No worker, employee or agent or sub-agent or any of contractor's dependents shall smoke or light anything within the factory premises. Carrying of match box/lighter or any other explosive and/or inflammable materials inside the plant, is strictly prohibited.
- 5.11 In case canteen facilities are utilized by the contractor's worker, employee or agent or sub-agent or any of their dependents, suitable amount will be paid to the canteen contractor directly by the contractor.
- 5.12 Contractor shall maintain suitable register/records to enter relevant particulars concerning each document handed over by GNAL to the contractor within the scope of work awarded to the contractor. Contractor will have to maintain all statutory registers, records and returns to be submitted under different laws. All records in electronic form should be backed-up on real time basis.
- 5.13 Contractor shall submit to the concerned Officer of GNAL daily statements, showing pending work and progress of work in such a format and manner as may be required.
- 5.14 GNAL reserves its right to do any or all the jobs mentioned under the scope of work departmentally or through any other agency for which contractor shall have no claim whatsoever.
- 5.15 Contractor shall faithfully, honestly and with due diligence and care, execute, perform and carryout all the work as per contract.
- 5.15.1 The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.
- 5.15.2 If, due to the negligence or delay attributable to Contractor or due to any failure on their part or their agent or their employee in exercise of due diligence, care, caution or economy or due to non-compliance of any of the provisions or written directions given by GNAL, GNAL suffer or are caused to suffer any loss or damage or incur any cost or expenses, Contractor shall be liable to reimburse and make good such losses and/or damages, costs and expenses immediately. The decision of GNAL in this regard shall be final and binding.
- 5.15.3 Any damage to buildings or to roads or to any other properties at site of work which may be caused by contractor or their agent or their sub-contractor or their employees, shall have to be repaired, replaced or made good by the Contractor immediately at their own costs as required by GNAL. In case, the Contractor fails to carry out such repair/replacement job, then GNAL will get

such job done and cost of such job will be recovered from dues payable to the contractor. The decision of GNAL in this regard shall be final and binding.

5.16 The Contractor shall ensure and deploy sufficient manpower and shall put such man-power into such a position so as to carry out and discharge obligations and liabilities under the contract and to carry out the jobs awarded to the contractor and to carry out the instructions given by the Officers In charge on behalf of GNAL, in such a way that the work is carried out properly, efficiently, smoothly, steadily, expeditiously.

5.16.1 In case if the contractor fails to provide required number of manpower as required by GNAL, GNAL shall arrange to bring-in such manpower at contractor's costs and risks. In such case the decision of GNAL will be final and binding to the contractor.

5.16.2 Contractor will provide an **effective supervision** on all the jobs awarded to them. The contractor shall engage suitably qualified and experienced full-time supervisors for the purpose. The contractor shall rotate 2% of his contract workers among various sites at different workplaces.

5.16.3 Child Labour shall not be engaged for any of the jobs.

5.16.4 Certain Jobs may have to be carried out ordinarily during daytime only. In case of emergency, jobs may be continued till the completion. In that case, prior written permission from the concerned authority shall have to be obtained by the contractor.

5.16.5 The decision of the requirement of number of persons, qualification of persons, tools & tackles and safety equipment's, for any jobs, will be diligently taken by the respective supervisor of the Contractor. However, such decisions shall be subject to review by the Officer In charge of GNAL, and his decision shall be binding to the Contractor.

5.16.6 The Contractor shall issue IS approved Safety Shoes/Items of Personnel Protective Equipment (PPE) every year to their contract workers. Contractor shall procure and issue Safety Items at his cost. It shall be the responsibility of the contractor to ensure that all the workers have been issued such safety items and they use the items while carrying out the jobs assigned to them.

In case of default, pertaining to use, misuse, non-use of safety items, the liquidated damages equivalent to double the price of safety item multiplied by the number of persons not using the items shall be levied by GNAL from the contractor.

In case the safety shoes / safety items have become non-usable due to any reason whatsoever, it shall be replaced against the old one at free of cost by contractor on instructions of the Concerned Department Head / Safety Officer of GNAL.

5.16.7 The contractor shall be required to submit information and statistical data in the prescribed format/s to the concerned authority before 15th of each month in

respect of work done in the previous calendar month, failing which the payment of the bills payable shall be withheld.

5.16.8 The Contractor shall submit to the Owner, details showing the number of each class of Contractor's Personnel on the Site. Details shall be submitted each calendar month, in a form approved by the Owner during the Term.

5.17 **Compliance with Applicable Labour Laws: -**

5.17.1 The Contractor will not employ any person below the age of 18 years or medically unfit for any work.

5.17.2 The Contractor shall issue, at his cost, Identity Cards to all its workers/representatives in prescribed format under Industrial Employment Standing Orders Act/ Factories Act. The updated details of all such cards and the changes made from time to time shall be provided to the Owner.

5.17.3 The contractor shall at their own expense comply with all Labour Laws and keep GNAL indemnified in respect of any claims, costs, expenses, demands, proceedings or losses arising out of or attributable to the Contractor's non – compliance with applicable Labour Laws. Some of the major liabilities under various Labour & Industrial Laws which the contractor shall comply with are as under, but not limited to:

(a) Payment of deposit in respect of each contract labour at the rate prescribed with the Office of Commissioner of Labour, as per the Contract Labour (Regulation & Abolition) Act, 1970.

(b) Licence fee as prescribed under the Contract Labour (Regulation & Abolition) Act, 1970 and the rules framed thereunder, depending upon the number of workmen employed by the contractor.

(c) Payment of retrenchment compensation, one-month notice pay and other liabilities as per the Industrial Disputes Act. Any payment of employee/s arising out of claim or dispute under the Industrial Dispute Act, 1947 or any other Labour Laws.

(d) The above are some of the contractor's major liabilities in addition to other liabilities prescribed under the various Labour Laws in force from time to time and as made applicable by the Statutory Authorities, which the contractor shall have to comply with.

(e) The Contractor shall employ adequate numbers of experienced staff at site for daily supervision and maintenance of various registers and records required under the Law and the Contract. No payment for supervision shall be admissible.

5.18 **Provident Fund and Pension Scheme:**

5.18.1 The Contractor shall submit along with their monthly bills, a Statement regarding deduction against Employees Provident Fund (PF) in respect of each concerned employee. PF, @ 12% or at the rates made applicable by

the Government from time to time of the basic wage rate/amount, shall be deducted by the contractor from the payment made to the workers who are eligible for PF deductions.

5.18.2 Contractor's contribution and workers' contributions towards PF and Pension Fund (PS) shall be paid by the contractor every month before 15th instant to Regional Provident Fund Commissioner's Office and the contractor will be required to show proof of the same to the HR Department of GNAL for verification. Contractor's contribution towards PF shall be deposited by the contractor with RPFC, Baroda. GNAL, in no way will be responsible for any non-compliance by the contractor.

5.18.3 Contractor's contribution to the professional fund shall be done as per rules and regulations valid from time to time

5.19 **Deposit Linked Insurance Scheme:**

The contractor shall have to deposit 0.5% (Half Percent) of the aggregate of wages in respect of employees who are members of the Provident Fund as the contribution to the Deposit Linked Insurance Fund with RPFC, BARODA or such contribution per worker as decided by the GNAL to GNAL.

5.20 Administrative Charges:

Administrative charges for maintaining PF, PS, EDLI Account shall be deposited by the contractor at RPFC, Baroda, at the rates applicable or such contribution as may be decided by the GNAL to GNAL.

5.21 Paid Leave Facility and Retrenchment Compensation:

5.21.1 Paid Leave Facility at the rate one day for every twenty days worked by the contractor's labour shall be provided by the contractor to their workers. The contractor shall maintain leave record/leave cards for individual labour which shall be duly verified and approved by the GNAL's Authorized Officer.

5.21.2 On termination of the contract, contractor shall serve one-month advance termination notice to his contract workers or shall pay wages in lieu of it. The contractor shall also serve general notice of termination of contract by displaying it on notice board. The contractor shall pay retrenchment compensation @ 15 days wages for every completed year of service and gratuity @ 15 days for every completed year of service to his eligible contract workers, on completion of contract. The contractor shall submit copy of written acknowledgement/declaration of his all contract workers for having received all his legal dues, on completion of contract. Unless such declaration of all workers engaged by the contractor is not submitted to GNAL the full and final payment shall not be made on completion of contract.

5.22.3 All payments like wages, bonus, leave wages, payment at the time of termination of services etc shall be disbursed in presence of GNAL HR representative and obtain signature of the HR representative indicating that payment is made in his presence. Any payment which is not disbursed in presence of HR representative of GNAL shall not be considered as a proof of payment to workers by GNAL.

5.23 Workment's Compensation and Employee's Liability Insurance:

- 5.23.1 The contractor shall be liable to pay compensation under the provisions of the Workmen Compensation Act, 1973. Insurance shall be effected for all contractor's employees engaged in the performance of this contract. If any of the work is sub-let with or without GNAL knowledge, the contractor shall require the sub-contractor to provide Workmen's Compensation and Employer's Liability Insurance for the latter's employees, unless such employees are covered under the contractor's insurance.
- 5.23.2 The contractor shall raise no claims against GNAL on account of payments to be made by them as indicated above. GNAL shall not be called upon to bear any liability whether financial or otherwise on these matters and the contractor shall satisfy the Government/GNAL authorities that all obligations in this respect have been duly fulfilled by them. Statements made in the inquiry documents or any other documents, if any, which are not in conformity with the above stipulation, should be deemed to have been withdrawn ab initio.
- 5.23.3 The contractor shall indemnify GNAL and its every member, Officer, Employee and Engineer against any claims, demands, costs and expenses whatsoever arising out of or in connection with the matters referred to in these Articles and elsewhere and against all actions, proceedings, claim, demand, costs and expenses which may be made against GNAL or by Govt. for or in respect of or arising out of any failure by the contractor in the performance of their obligations under the documents. GNAL shall not be liable for or in respect of any demands or compensations payable under any law or in consequence of any accident or injury to any of their workmen or other person in their employment or their sub-contractor and the contractor shall indemnify and keep indemnified GNAL against all such damages and compensation and against claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.
- 5.23.4 GNAL shall be entitled to deduct directly from the bills to be paid to the contractor, any sum or sums payable by the contractor and which sum/sums, GNAL is required to pay on account of their default in respect of all liabilities referred to in above clauses.
- 5.23.5 The Contractor shall be responsible for all matters arising out of the performance of the Contract and shall comply and adhere to, at their expense with all laws. The Contractor shall indemnify and keep indemnified fully and save GNAL harmless against all liabilities in this respect. The Contractor shall be fully responsible for the work, conduct, supervision and control of all their own personnel and GNAL shall in no way be held liable and responsible for supervision, control, etc. of these personnel. Since the contractor shall have full and exclusive supervision and control over contract awarded to them and the persons engaged for the purpose under this contract, the contractor shall be responsible and liable under the provisions of civil and criminal laws, labour laws etc for their work, behavior and Industrial Relation problems and GNAL shall have no responsibility whatsoever on this account.

- 5.23.6 The contractor shall ensure that all the employees engaged by him are medically fit and are free from all communicable contagious infections and other diseases and every year, the contractor shall submit Medical Fitness Report / Medical Examination Report from qualified medical practitioner for all contract workers deployed by him, and GNAL shall have the right under Clause No.2.3.17 to ask the contractor to remove any of his employee/s.
- 5.23.7 The contractor shall be liable and responsible for their employees observing rules and regulation of the GNAL including the security and safety regulations provided under the laws and instructions that may be issued by GNAL from time to time. In case GNAL suffer any loss etc. of whatever nature on account of contractor's employees not following the security and safety regulations / instructions, the contractor shall be liable to make good all such losses as may be determined by GNAL at his sole discretion. GNAL shall have the right to recover all such losses etc. from the dues payable to the Contractor and from the Contract Performance Security, as the case may be and by other remedies available under the law.
- 5.23.8 The workers permitted inside the CS Plant should be engaged for the specified work only and their movement inside the CS Plant shall be restricted by the contractor to the area of the specified work only under the contractor and should not be employed in other jobs inside the CS Plant.
- 5.23.9 Contractors workers/supervisors will have to observe the CS Plant shift hours and will not be permitted to enter or go out any time as they like. For any odd hours entry or exit, the contractor has to make a request and only after considering it proper adequate passes would be issued to the contractor.
- 5.23.10 If in GNAL's opinion any of Contractor's Personnel are found to be suffering from any disease or if any employee is found to commit any misconduct or misbehavior on in GNAL's opinion undesirable, GNAL at its sole discretion, may require the Contractor to remove such Contractor's Personnel or prevent them from entering the CS Plant . It is clarified that GNAL reserves its right to cancel token/entry/exit passes of all or any of contractor's workers, supervisors, agents, etc. without giving any reasons whatsoever for the same.
- 5.23.11 The Contractor shall do the job with utmost care, speed, precision and follow all the instructions / directions / formalities for execution of this work. If GNAL suffer any loss towards demurrage, wharf age, detention and other charges, loss of materials, loss of energy, loss of any property, etc. due to delay and/or negligence on the part of contractor and/or their employees, the same will be recovered from the Contractor's invoices or from the Initial Performance Security or the Contract Performance Security as the case may be. GNAL's decision in this regard will be final and binding to the Contractor.
- 5.23.12 All contractor's workmen/employees/agent and their tiffin's/bags, etc. will be liable to security check at any time and at the time of entry/exit.
- 5.23.13 The contractor hereby accepts his obligation to ensure that workmen shall observe discipline, work peacefully and shall not cause or create nuisance or disturbance in or around the GNAL's premises.

- 5.23.14 The contractor also accepts and acknowledge that he will be responsible for and will ensure that none of his workmen carries any intoxicating material or weapon or any dangerous thing in the GNAL or enters the GNAL under influence of any Drugs or Alcohol/ Liquor or other intoxication substance.
- 5.23.15 The contractor undertakes to ensure that no illegal activity or theft or undisciplined behaviour is done by his workmen and if any such illegal activity, theft or undisciplined behaviour is done by any of his workmen, the contractor will take strictest legal action against such workmen including lodging of complaint with police and handing over the concerned workmen to police authorities.
- 5.23.16 The contractor undertakes to ensure that no political activity is done by his/her representative and/or his/her workmen.
- 5.23.17 The Contractor will be solely responsible for ensuring compliance of the terms and conditions of the Contract and Laws, by the Contractor's Personnel. The Contractor acknowledges that the Contractor's Personnel will be under the complete control and supervision of the Contractor. For the avoidance of doubt, it is expressly clarified that no relationship, including employer – employee or master – servant will come into existence between the Contractor's Personnel and the Owner. The Contractor shall indemnify the Owner against all the claims raised against the Owner with regard to the services being rendered by the Contractor / Contractor's Personnel.
- 5.24 Rates and Remuneration:
- 5.24.1 The Parties acknowledge that the Contract is a fixed price contract quoted by the Contractor as part of the 'Price Bid' and agreed by GNAL. (**"Contract Price"**)
- For the avoidance of doubt it is clarified that the Contract Price shall be inclusive of all costs of material, labour (including any payments or contributions that may be required to be made in relation to the Contractor's Personnel under Labour Laws).
- 5.24.1 GNAL will have the right to recover the damages/losses at its discretion, terminate the contract in part or full and get it executed through some other agency, at contractor's sole risks and costs, in the event of non-performance, non-fulfillment of contractual terms or breach of contract, namely but not limited to:
- (a) If the contractor fails or neglects to execute the work and/or,
 - (b) If the progress of the work is not satisfactory and/or
 - (c) Non-fulfillment of any of the terms and conditions of the contract
 - (d) If the contractor does not deploy adequate manpower/ tools & tackles for the services stipulated under the contract, GNAL will have the right to employ people from any alternate source and recover the extra cost incurred from any of contractor's Bill/s or Bank Guarantee. GNAL reserves the right to terminate the contract without assigning any reasons or without payment of

compensation. The decision of GNAL in this regard, shall be final and binding to the contractor.

- 5.24.2 The contractor is not appointed as an exclusive party for this job and GNAL reserves the right to appoint one or more agencies.
- 5.25 Payment to the Employees, Labours employed by the O & M Operator:
- 5.25.1 The wages of all employees employed by the contractor under this contract, shall be paid by the contractor before expiry of 7th day after last date of the month in respect of which wages are payable (i.e. wages of a month have to be paid by the contractor in the first week of the following month). The minimum basic wage rates as notified by the Government or any such other Authorities will have to be paid by the contractor to all their workers. The payment of overtime shall be as per the provisions under Factories Act. The payment of wages, advances, bonus, settlement of employee's legal dues, etc. shall be substantiated by documents of bank transfer or any other mode of payment and shall be a part of the invoice submitted by the Contractor and documentary evidence of workmen staff as specified in the statutory rules needs to be submitted to GNAL every month for compliance of the same.
- 5.25.2 This Clause will apply even to differential payments and such differential payments made subsequently as arrear payment.
- 5.25.3 The value of job done at the rate agreed herein shall constitute the sole and inclusive consideration for the contractor under contract and no further or other payment whatsoever shall be or become due payable to the contractor under the contract.
- 5.25.4 Contractor will prepare their bill/s in duplicate with duly signed at the end of each month for the work done and will submit the bills to Concerned Department.
- 5.25.5 Concerned Department will forward Contractor's bills to GNAL for certification that the Contractor has adhered to and complied with all statutory conditions in respect of Payment of Minimum Wages, Bonus, PF, Workmen Compensation and Earned Leave to his workers and other laws to be observed by them under various applicable Labour Laws, Bill will be then forwarded for payment.
- 5.25.6 Contractor will submit copy of Paid Challans of PF, Professional Tax, Labour Welfare Fund etc. with Attendance Register, Attendance Card, Shift Schedule, Salary Register etc. to GNAL every month for verification.
- 5.25.7 The contractor will be paid his bill amount after certification by GNAL within 30 (thirty) days of submission of bills to GNAL, after deduction towards Income-Tax, etc.

- 5.26 Area of Work:
- 5.26.1 The contractor shall be responsible for deploying all categories of labors as per the pre-assessed manpower requirement agreed with the GNAL for execution of job awarded to him in all the Plants/Units/Departments/ Area as allotted to him from time to time.
- 5.26.2 The contractor shall engage Competent Supervisors to supervise the work of his workmen in compliance with the contract and the names of Supervisors shall be given to GNAL and the Concerned Department In-charge.
- 5.26.3 The contractor and / or authorized supervisor shall be available at work site and shall handle all the issues arising out of his contract workers, contractual obligations etc. In case of any damage of physical or financial nature caused by contractor's worker shall be recovered from the contractor.
- 5.26.4 The contractor will be required to maintain requisite registers, records, etc. as required to be maintained under applicable statutes and would be required to show the same to representative of GNAL on demand.
- 5.26.5 The contractor shall not deploy more number of laborers than mentioned in the Contract Labour License as per Section 12.1 of Contract Labour (Regulation & Abolition) Act.
- 5.26.6 The said License shall have to be renewed from time to time by the contractor without any default.
- 5.26.7 The contractor shall have to maintain record of details of workers employed in Form No.13, giving the details of their date of entry, full address and their specimen signatures or left-hand thumb impression.
- 5.26.8 The contractor shall issue attendance card in Form No.14 to all the labour deployed by him. Electronic / Bio matric attendance registration system may be introduced for hassle free and accurate attendance record.
- 5.26.9 The contractor shall maintain attendance register in Form No.16 and salary register in Form No.17. The contractor shall also issue salary slips to all the labour deployed by them in Form No.19 before the disbursement of salary is made.
- 5.26.10 The contractor shall maintain the register of advance in Form No.23 and any advance disbursed to any labour should be in presence of the representative of GNAL.
- 5.26.11 The contractor shall maintain overtime register in Form No.23.
- 5.26.12 The contractor shall prepare shift schedule in respect of labour required to be deployed in shift A, B & C respectively and shall arrange to submit to GNAL on or before 25th instant of the previous month.

- 5.26.13 The contractor shall display on their Notice Board giving the details of wage period, place of disbursement of wages and time. The copy of this notice should be sent to GNAL at least 24 hours before the disbursement of wages is to be made.
- 5.26.14 The contractor shall maintain wage deduction register in Form No.20 and fine register in Form No.21.
- 5.26.15 The contractor shall prepare half yearly return in Form No.24 on 30th June and 31st December respectively and shall submit the same on the next working day to GNAL without fail. The contractor shall forward the Half Yearly Return to the Labour Commissioner, Government of Gujarat, Ahmedabad.
- 5.26.16 The contractor shall maintain the leave register required under the Factories Act.
- 5.26.17 The contractor shall issue Identity Card with Photograph to all the labour deployed by them within 3 (Three) days of their date of entry.
- 5.26.18 The contractor shall immediately inform to Departmental Head, shift In charge and the GNAL any accident occurred in the premises of GNAL and shall fill-up the accident form in Form No.21 and submit immediately to GNAL.
- 5.26.19 The summary of the Contract Labour Regulation Act in Gujarati would be displayed by the contractor on their Notice Board. The contractor would also exhibit the notice on their Notice Board at the place of work regarding hours of work, wage period, place of wage disbursement and its time and send the copies of these Notices to the Local Officer of the Factory Inspector and to GNAL.
- 5.26.20 The contractor shall keep and maintain all records, registers, returns, etc. in GNAL premises and should be updated from time to time and should be shown to the representatives of GNAL on demand.
- 5.26.21 The contractor shall send a copy of all the notices, shift schedules, etc. to the concerned Government Labour Officer or Factory Inspector as the case may be, with a copy to GNAL.
- 5.26.22 The contractor shall maintain Provident Fund eligibility register and Provident Fund Deduction register, etc. and shall submit to the GNAL every month for inspection.
- 5.26.23 The contractor shall maintain register A, B & C under payment of Bonus Act, 1965 and shall submit to the GNAL on demand.
- 5.26.24 The contractor shall within 10(Ten) days after last date of the month, submit to GNAL a certificate/declaration duly signed, stating that they have complied with all requirements of the Labour Laws and PF Act and has not committed any default or breach of any law applicable to them.
- 5.26.25 The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid

facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

- 5.26.26 The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Contract, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.
- 5.26.27 The Contractor shall send, to the Owner, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require

5.27 General

- 5.27.1 The Special Conditions of the Contract shall be read in conjunction with the General Conditions of Contract (GCC), other sections of bid documents and any other documents forming part of this Contract wherever the context so requires.
- 5.27.2 Where any portion of the Special Conditions of Contract is repugnant to or at variance with any provisions of the GCC then unless a different intention appears, the provision of the Special Conditions of Contract (SCC) shall be deemed to override the provisions of the GCC only to the extent that such repugnancy or variations in the SCC are not possible of being reconciled with the provisions of GCC.
- 5.27.3 Wherever it is stated anywhere in this bidding document that such work has to be carried out, it shall be understood that the same shall be effected / carried out by the O&M Operator at their own cost, unless a different intention is specifically stated herein or otherwise explicit from the context.
- 5.27.4 In the case of any discrepancy, defective description, errors, omissions or ambiguity between or in any of the contract documents, the O&M Operator shall promptly submit the matter in writing to the Owner's Representative who shall within a reasonable time address the same in writing. In all such cases the O&M Operator shall promptly proceed in accordance with the instructions given by the Owner's Representative.
- 5.27.5 The workmanship shall satisfy the relevant Indian and International Standards and prudent industry practices.
- 5.27.6 In case of contradiction between Indian or other applicable Standards, General Conditions of Contract, Special Conditions of Contract, Specification, Schedule of Prices, the following shall prevail in order of precedence
- (i) Letter of Acceptance along with Statement of Agreed Variations, if any
 - (ii) Price Schedule
 - (iii) Instruction to Bidders
 - (iv) Special Conditions of Contract

- (v) Specifications
- (vi) General Conditions of Contract

5.28 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or procure all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining fulfillment of the service level agreement for O&M services at the facilities.

5.29 **Spares and Consumables Management:**

As a general principle all spares and consumable shall be made available by the Owner through its centralized store management system operated on SAP platform. The O & M Operator shall get required material issued following the procedure set by GNAL, which it may get acquainted with.

For ease of operation GNAL would allow O & M operator to source the spares/ consumable not exceeding the value of Rs. 25000/- on reimbursable basis (with documentary evidence of purchase and use) for which the prior approval of GNAL is to be taken. The O & M operator shall ensure that the items thus procured are only for maintaining the smooth operation of the plant and not available in GNAL store.

5.29.1. Spare issuance.

The O & M operator shall review the available inventory of the spares that GNAL has procured together with the equipment. These spares shall be issued to O & M operator as and when requisitioned through set procedures The O&M operator shall return the used spares/scrap back to GNAL stores/ at designated place.

5.29.2 Procurement of new spares.

The O & M Operator shall monitor the spares inventory in the owner's store. The lead-time for procurement shall be kept into consideration while planning the spares requirement. The minimum inventory principle should also be followed in close coordination with the Owner.

5.29.3 Consumables.

All Consumables required for O & M services shall supplied by the owner as free issue material except for those in the scope of the O & M operator for running of the units / equipment for example diesel, oil etc for movable equipment which are brought by O & M operator.

5.30 Pre-commissioning and Commissioning Support

Since the plant is heading towards the pre-commissioning and commissioning stage, the O&M Operator shall bring in their pre-commissioning and commissioning team for successful commissioning of the CS Plant as per the milestones set by GNAL/ GNAL's engineering consultant.

The Pre-commissioning and Commissioning support would start at the onset of the pre-commissioning of the plant. It will continue till the completion of commissioning of all the units, and integrated start-up of the entire plant. The commissioning stage may continue till the time when Guarantee Test Run is successfully completed. Thereafter, the O&M phase will be started. If GTR is delayed for some reasons, the O&M period may start prior to GTR by mutual agreement. GTR of the Plant will be conducted under the complete supervision of the O&M contractor, but under the guidance of process licensor and GNAL representatives. Complete pre-commissioning and commissioning process is expected to be carried out smoothly, so that gradually equipment are handed over from the GNAL/package unit contractor/s to the O&M Operator. This would also include daily, weekly and monthly reporting of the commissioning progress and tracking of the important milestones. The O&M operator will also ~~have to~~ mobilize its staff for enabling the pre-commissioning and commissioning and trials of the units with all related system like Primary Brine, Secondary Brine, Brine purification, Cell House, Anolyte & Catholyte System, Cl₂ Treatment, Cooling, Drying, Compression, Refrigeration, Cl₂ Liquefaction, Storage and vaporization, HCL Synthesis, Waste Air De-chlorination, Caustic Evaporation, & flaking, H₂ compressors & Bottling, N₂PSA, Chilled water system, Storage tanks RVDF, SRS, packaging etc. Preparation of punch points during the pre-commissioning stage and the commissioning stage will be done by the O&M team and followed up with GNAL. Punch points not requiring major material or services of the OEM/Vendor will be closed by the O&M operator with intimation to GNAL. The O&M Contractor will ~~have to~~ provide sufficient staff which would include operation, maintenance & commissioning staff along with the technicians of the respective discipline.

The selected O&M Operator would be paid the charges during Pre-Commissioning and Commissioning support as per the price schedule. For the Pre-commissioning stage, the contractor needs to mobilise well in time as mutually agreed and deploy required number of personnel with required skill –sets, including supervisors as required by the owner. The deployment strength shall be ramped-up as the pre-commissioning proceeds and the full strength shall be achieved before the plant enters the commissioning stage.

5.31 O&M Services

The O&M Operator shall mobilize its O&M services team to the plant as advised by the Owner so that the agency can participate in all pre-commissioning & commissioning activities and take over the O&M of the plant immediately after commissioning. The O&M Operator shall acquaint themselves with all aspects of Caustic Soda Plant before taking over the O & M of the plant. The O&M shall carry out overall planning and scheduling required for O&M during this period. The Owner may consider providing relevant training to Contractor's selected personnel in one of the operating plants of GACL in Dahej and /or Vadodara. Such training shall be subject to separate terms and conditions to be agreed with GACL by the Contractor.

5.32 Care of Facilities

The Contractor shall be responsible for the care and custody of the supporting facilities handed over to/used by the Contractor, which may include Time office, Canteen etc. or any part thereof during the complete tenure of the O&M contract.

5.33 Caustic Soda Plant Takeover

On successful completion of Commercial Operation on COD, the O&M Operator shall take over the plant from the Owner and start operating and maintaining it on their own and would be bound by the guaranteed performance parameters. O&M fees shall be applicable from the date of takeover of respective unit for the operating period. However, liquidated damages & incentive mechanism would start after 360 days of the takeover of the unit or as mutually agreed. In case of design issues noticed during the takeover of O&M, GNAL will take up those with the EPCM Consultant / equipment supplier. If required, the same will be financed by GNAL but the execution and expediting with the suppliers shall be done by the O&M Contractor. No extra charges will be applicable for the above to the O&M vendor.

5.34 Annual budget exercise/ Capital Expenditure

The complete budget for the raw materials, auxiliary materials, packing materials, consumables and spares for the following year shall be prepared and submitted by the O&M contractor on the 15th of every November for consideration in the yearly budget.

The major capital expenditure shall also be planned in advance for considering in the annual budget.

5.35 Capital expenditure as may be required for improvement in the plant performance shall be jointly assessed by both the O&M Operator as well as the Owner. The work/major modification under capital expenditure to increase plant efficiency/reliability of the system/safety of the plant and personnel (other than operational expenditure) during the period of agreement shall be approved and financed by the Owner and supervised and carried out by the O&M Operator. No additional fees shall be paid by the Owner for such work.

5.36 Terms of Payment

The Contract Price shall be paid as per Terms and Procedures of Payment.

(A) Initial 10% interest free advance payment of total O&M contract price for first year subject to fulfillment of following conditions

1. Acceptance of letter of Intent (LOI)
2. Furnishing initial performance security @ 10% of O&M contract price for first year in the form of Bank guarantee in the prescribed format from the Nationalized/ approved private Bank valid till one year from the date of issue of BG with an extra claim period of three months from the date of expiry of the BG. (BG as per prescribed format)
3. Signing of the agreement for O&M services.
4. Submission of an unconditional Bank Guarantee in the prescribed format from a Nationalized / approved private Bank covering advance amount valid up to 01 year from the date of issue of BG. (BG as per prescribed format)
5. Advance payment shall be recovered from the monthly bills on prorated basis over the period of the first year of the contract period.

(B) Pre commissioning and commissioning charges

Pre commissioning & commissioning charges will be paid in proportion to manpower deployed as explained in price schedule (Attachment 11) until the commissioning of the Plant. Invoice for pre-commissioning & commissioning charges to be raised on a monthly basis. The payment shall be made after 30 days of receipt of invoice. 10% of the basic invoice value will be retained and the same will be released on completion of the Commissioning or on submission of BG of an equivalent amount valid for six months with a claim period of three months.

C) The O&M Fees would be paid in 12 (twelve) equal monthly installments with the credit period of 30 days after submission of technically clear bills with all documentation as required. 10% of the invoice value will be retained and will be payable at the end of the year after resolution of all performance guarantee liquidated damages and bonus for that year or on submission of BG of an equivalent amount valid till the completion of the corresponding year with acclim period of three months.

5.37 Submissions

The O&M operator shall submit a daily report to the Owner's representative in an agreed format. The Operator shall also enter, through qualified personnel, relevant Operation and maintenance data in SAP. The O&M operator shall submit the plant performance report to the Owner at the end of each month along with the copies of invoices. The plant performance report shall contain, but not limited to, the following:

5.37.1 Submissions during pre-commissioning and Commissioning Support (Not limited to)

1. pre-commissioning and Commissioning Plan and Schedules
2. Documentation of Design decisions, assumptions and tradeoffs.
3. Pre-commissioning and commissioning checklists for all the systems.
4. Change request forms for changes in designs and P&ID Diagrams.
5. Monitored data logs during pre-commissioning and Commissioning
6. Minutes of the meetings held.
7. Draft pre-commissioning and Commissioning Reports.
8. Project Delivery Reports
9. Handing over procedures
10. Deferred Functional Test logs
11. PG Test reports and recommendations
12. Compilation of the punch points experienced during the commissioning stage and monitoring of the same.

5.37.2 Submissions during O&M Support (Including but not limited to)

1. Summary of major O&M activities and safety related issues
2. Trip Analysis Report with root cause analysis and corrective action to be taken
3. Summary of all Scheduled / Unscheduled maintenance outages

4. Summary of any untoward incidents such as accident, etc (in the agreed format)
5. Details of plant manpower deployed,
6. Details of the stock, consumption, planning for procurement and ordering details of the spares, consumables & lubricants
7. Plant performance parameters –as per the requirement of GNAL
8. Monitoring and reporting Consumptions of various utilities by CSP and supplied to CLM to enable billing of the same by GNAL to the respective users
9. Any services received from other agencies, including GACL
10. Planning for the procurement of spares and consumables

5.38 Sale of Products

The O & M Contractor shall be responsible for dispatches of all the products as per the agreed plan with owner/ GACL marketing team.

5.39 Raw material specifications

GNAL intends to supply the required quantity and quality of Raw materials and Auxiliary materials to maintain the Production at the designed capacity of Caustic Soda Plant. The plant performance and parameters need to be maintained at design conditions. In case of deviations in quality of the Salt, the plant parameters shall be suitably adjusted by the Contractor. It may also be noted that during monsoons etc., there may be a requirement to cover the materials stored in open area with tarpaulins etc., especially Salt, which will be in the scope of the O&M Contractor

5.39.1 Quality Control for Raw Materials / Auxiliary Materials

The sampling shall happen with every consignment at all modes of delivery of Raw materials and chemicals so as to meet the acceptability of the product as per the design parameters which will be shared with the O&M operator before receipt. The O&M Contractor may verify the quality as per required specifications when the material is issued for use.

5.40 Performance Targets for the Operator

The operator needs to achieve the performance target parameters as defined in this Contract, and as changed from time to time.

Failure to achieve these indicated performance parameters would attract a levy of liquidated damages. Incentive would be paid in case of improvement in these parameters.

The Electrolysers will be commissioned in a staggered manner based on the availability of power. The plant is currently under erection stage. Pre-commissioning activities are expected to start in December 2020 and Commissioning of the plant is expected to start by March 2021 or as to be notified to O & M Contractor. The milestones to follow would include water flushing, Water circulation, Hot/ cold, Brine Preparation, Pressure testing of Gas Lines, Pre commissioning, Cell element Preparation and assembly, Testing and Startup of plant. Site Acceptance Test of DCS etc.

5.41 Billing and Payment - Submission of Invoices

- 5.41.1 The proforma of the monthly invoice and the documents and details to accompany invoices shall be mutually discussed and agreed to by the two Parties.
- 5.41.2 The O&M Operator on completion of every month shall submit the invoice for that month during the first week of the next month with requisite details of performance parameters. The payment shall be effected after 30 (thirty) days of the submission of the technically clear invoices.

5.42 Escalation / Price Variation

- 5.42.1 The selected O&M Operator would be paid fees for each year as per the prices quoted by him in his bid. The base prices (prices quoted for five years) shall be kept FIRM till the completion of the Term. No price variation on the final prices as per contract for each respective year will be allowed until the end of the term of five years.

5.43 Statutory Approvals

- 5.43.1 During the contract period, it shall be the O&M Operator's responsibility to obtain all statutory approvals and also provide the inputs to GNAL including relevant information, intimations of expiry as required by GNAL. GNAL will provide all documentation required for the statutory clearances and will also pay the statutory payments for the statutory clearances. Timely compliance of all required statutory clearances and requirements for the Caustic Soda Plant will be the responsibility of the O&M Operator.
- 5.43.2 It is the responsibility of the O&M Operator to ensure that the parameters of operations governed by the statutory norms given by various statutory boards/GPCB/CPCB etc. are maintained so that any corresponding inspection does not affect certification or operation of the CS Plant in any way. O&M Operator shall also provide full co-operation to personnel from such statutory bodies who may visit the site for inspections. O&M Contractor shall also be responsible for any consequential financial impact to the Owner on account of his failure to comply with statutory norms during the operation.
- 5.43.3 Any changes / additions to the work required as stipulated by the statutory authorities shall be carried out by the O&M Operator at no additional cost to Owner. The inspection of the works by the statutory authorities shall in no way absolve the O&M Operator of their responsibilities. All documentation necessary shall be submitted by the O&M Operator to the Owner/authorities in this regard.

5.44 Tools & Tackles and Software

The O&M Operator shall be solely responsible for making available and using the tools and tackles required for executing the complete O&M at GNAL's Caustic Soda Plant at Dahej, Bharuch, in addition to the tools and tackles handed over to the O&M Operator by the Owner. The O&M Operator shall install the necessary software compatible to SAP, if required, for monitoring Plant maintenance, Caustic Soda Plant Performance, Optimization and Diagnostics in consultation with the Owner. The price of such a software will be included as a separate line item in the bid process. However, it may be noted that all equipment's other than being supplied

by GNAL initially and needed for the maintenance and conduction of the works covered in the scope of this contract including condition monitoring equipment's, welding and similar machines, consumables for the same will be in the scope of supply of the O&M contractor.

5.45 Pre-bid visit to GNAL Caustic Soda Plant, Dahej, Bharuch

On submission of the bid, it shall be assumed that the bidder has considered all the specifications, situations and scenarios mentioned explicitly, implicitly or not mentioned in the bid document or in any interaction with the Owner including and not limited to the visit to CSP at, Dahej, Bharuch and the queries raised by the bidder. The visit to the facility shall provide an opportunity to the bidder to take a stock of the plant assets to get a better idea of O&M requirements. The Owner holds no responsibility whatsoever towards any lack of information that the bidder may feel necessary for bidding.

5.46 Quality System

The O&M Operator shall submit the organization structure planned for execution of the contract which includes the names of team members that would be involved from their side for the execution of the project for commissioning support as well as for O&M. The O&M Operator shall follow all such quality initiatives as per the global standards to ensure that O&M meets such standards. O&M Operator shall maintain quality records of all overhauls, tests and inspections pertaining to the systems / equipment under scope of contract.

5.47 Safety

The O&M Operator shall maintain and carry out practices for Environment, Health & Safety (EHS) as per the prudent Industry practices.

5.48 Disposal of Wastes & Scrap

The O&M Operator shall ensure the disposal of wastes like waste oil and lubricants, sludge from the Polishing filter, sludge filter (RVDF) and other areas of Plant, used cleaning rags, office waste, used and generated during the O&M of the Caustic Soda Plant. The items are to be disposed off properly and responsibly as required by the environmental agencies and statutory bodies. Any waste produced in the process of operation and maintenance of the Caustic Soda Plant including offices will fall in this category. The OHC waste will be disposed in the statutorily acceptable manner. Waste oil, chemicals etc. will be disposed through GPCB registered vendors and all such records will be copied to GNAL.

Any scrap generated inside the plant premises shall be collected, stored properly and handed over to the Owner for disposal on a quarterly basis or as mutually agreed periodicity). GNAL shall be the sole Owner of any such scrap.

5.49 Facilities for O&M Operator inside Plant Premises

O&M Operator shall be handed over the facilities available at the plant for the entire duration of the contract.

- i. Transportation: O&M operator will arrange for transportation of his staff/workers/labour at his cost.

- ii. Medical Facilities: An Occupational Health Center (OHC) shall be maintained by GNAL, where preliminary health care services shall be provided by GNAL to the O&M Contractor for its employees/workers on chargeable basis (the charges to be mutually agreed). In addition, O&M Contractor to maintain its own supplies of first-aid items within the plant at designated places at its own cost.
- iii. Canteen Facilities: GNAL intends to maintain a centralized canteen facility from where food items etc. may be collected by the O&M Contractor on chargeable basis for distribution amongst its employees/workers. In addition O&M contractor may consider keeping vending machines for snacks / drinks etc. within the plant premises at its own cost. Prior written permission of the owner for any such installations shall be taken.
- iv. Potable water –The O&M operator may either install his own suitable RO plant etc for providing portable water for his consumption. The O&M Contractor may also consider installing water coolers at appropriate locations, at his own cost, with prior permission of the owner.

The O&M Operator would arrange for the movable furniture, computers, printers, scanners, copy machines etc., as required, at site to carry out the O&M activities smoothly. Office and maintenance area space will be allotted as available. However due to compact design of the Caustic Soda Plant the O&M contractor may have to deploy temporary offices/store/site maintenance rooms as per their requirement for which GNAL shall provide space if available.

5.50 Execution of Work

The O&M Operator shall be entirely responsible for executing the work covered under this bidding document in a professional manner.

Besides the above, the following may be noted regarding execution of the works:

- i. In case of emergency repairs required in the water line of GIDC, the O&M Operator may be required at his cost to provide necessary manpower and minor spares to attend to the fault to avoid downtime to the CS Plant.
- ii. Any additional material handling equipment required for operating/maintaining the plant from the ones being handed over by GNAL will have to be provided by the O&M Contractor.
- iii. Any temporary civil work / other works required for the upkeep of the plant will be carried out by the O&M Contractor.
- iv. Monsoon preparations work will be planned and carried out by the O&M contractor before the onset of the monsoons.
- v. Chemical treatment of the water in all the reservoirs other than the treatment provided by GNAL will be in the scope of the O&M operator. Necessary chemicals required after system installation will be in the scope of the owner.
- vi. The O&M operator shall provide suitable experienced personnel like Experienced DCS Engineer/ shift engineer, Experience Technicians, IBR approved welders, to ensure statutory compliances
- vii. The O&M agency shall deploy experienced operators for the workshop which shall cater to the requirement of the complete complex.
- viii. Experienced store personnel, maintenance and operation planners, efficiency calculation personnel shall be deployed by the O&M contractor at the site.
- ix. SOP for all works including but not limited to Operations, Maintenance, chemicals handling and other works in the Caustic Soda Plant etc, shall be

prepared and executed by the O&M contractor after due approvals from GNAL.

- x. Immediately after taking over the CS plant for O&M, the O&M operator will initiate actions to get certification under various Quality Management systems, Environment management system, OSHA, Energy Management Systems etc. The Operator shall recruit suitably qualified personnel and / or provide necessary training to his personnel for obtaining and maintaining the certifications.
- xi. O&M operator shall arrange for necessary technical training of their personnel at the OEM works etc. at their cost.
- xii. The Owner shall arrange training at the CS Plants of GACL (at Dahej & Vadodara) for a limited number of personnel recruited by O&M Operator prior to pre-commissioning. These trainings will be at the terms 7 conditions to be agreed between O&M Contractor and GACL.

5.51 Manpower

5.51.1 Estimated manpower – For Pre-commissioning mobilization the number of personnel progressively required shall be worked out jointly. For commissioning, normally, more number of personnel is required than the normal Operation & Maintenance of the plant. This can be achieved by either deploying additional personnel with required skill sets or by having the regular set of personnel working in 12 hours' shifts during the period of commissioning. The tentative manpower requirement for the O&M services the scope of which has been indicated would be around 300 numbers, excluding supporting staff. Manpower required for other administrative jobs like housekeeping, accounts, HR, etc. could be additional to the above figure and would depend on the plan of the O&M operator. However, O&M Operator to finally indicate his plan of manpower requirement and submit the proposed Organogram with number of personnel deployed taking into consideration the scope of work mentioned. The O&M operator to plan sufficient quantum as well as qualified manpower to cater to all the requirements to meet the scope of work as mentioned. The pre-commissioning and commissioning stage will also be used by the O&M operator to acquaint himself of the complete equipment/process/design in the plant, the operations of the same as well as for the preparation of necessary SOPs etc, for the smooth running of the Plant.

5.51.2 Skill Matrix of O&M contractor's deployed Personnel

The details are provided in Annexure 5

It may be noted that the appointment of HOD / In-charge and senior personnel of O&M Operator will have to be approved by GNAL after review of the relevant CVs and Interviews if necessary by GNAL.

5.51.3 Site working guidelines

Plant operations shall be covered on 24 hrs., three shift basis with emergency coverage as necessary. Day shift working shall be on 6 days a week basis with skeleton maintenance staffs present during all holidays. The public holidays to be observed by the O&M Operator shall be the same as those observed by GNAL. A list of Public Holidays for the next calendar year shall be communicated in the month of December of the previous year. The working guidelines shall be in accordance with the Factories Act and rules framed thereunder. Regarding any leave for more than seven days (other than SL) to be taken by HOD / In-charge and above level

technical personnel, the O&M contractor shall inform the Owner at least two days prior to availing such leaves by those personnel. The Contractor shall also make back-up arrangement, as acceptable to the Owner, during such period to ensure that the O&M activities are not hampered or weakened in any way.

5.52 Co-ordination Responsibilities of O&M Operator towards Other Agencies

The O&M Operator's responsibility covers the coordination of all the works involved and the expenses of site mobilization and demobilization including clearing activities. This includes the coordination during the commissioning stages with the EPCM personnel for smooth commissioning of the CS Plant. The quoted prices are deemed to have appropriately catered for these and no separate claim whatsoever shall be entertained. During the operating tenure, the O& M contractor representatives will coordinate with the representatives of CPP, CLM Plant and Other customers for a smooth supply of products and utilities through pipelines as per required quality and quantity. The O&M contractor shall follow all protocol as determined from time to time.

5.53 Other Conditions

The site In charge of O&M Operator shall ensure the following:

- i. The plant is operated efficiently and at desired capacity as agreed with the Owner
- ii. Tools and Tackles are in good condition
- iii. All equipment are in healthy condition
- iv. All the safety, environment, security and regulatory norms are strictly complied with.
- v. The plant availability on regular basis
- vi. Production & dispatches of the products as per agreed planning on daily basis.
- vii. Coordination with other units/plants and outside agencies including statutory authorities

5.54 Contract Revision

The revisions in the contract can be made by mutual agreement amongst the owner and the O&M contractor if found necessary at a later date.

5.55 Right of inspection

The Owner and the Owner's Representatives shall, at all times, have full access to all parts of the Site and the CS Plant to carry out or procure an inspection of the Facilities to assess whether the O&M services are being performed in accordance with the terms of the Contract.

5.56 Set-off

Owner may set off any sums due and payable by it to the O&M Contractor under this Contract against any sums payable to the Owner by the O&M Contractor.

5.57 Assignment

The O&M Contractor shall not be entitled to assign its rights or obligations under the Contract to any person, save and except with the prior consent in writing of the Owner, which consent the Owner shall be entitled to decline without assigning any reason

Chapter 6

6.0 Performance guarantees

6.1 The penalty and incentive mechanism would be applicable from the date of the setting up of benchmarking of Plant operation and maintenance . The O&M Operator needs to achieve the target performance parameters within 360 days from the date of taking over of the Plant

The O&M operator shall guarantee broadly the following parameters, standards for which shall be finalized at appropriate time

- i. DC & AC Power consumption per MT for Electrolysis, at Rectifier terminals
- ii. Auxiliary Power consumption
- iii. Consumption of Salt & other auxiliary Chemicals
- iv. Maintaining Brine quality so as to achieve maximum life of Membrane and Anode/Cathode coatings
- v. Expected life of Membrane & Anode/Cathode coating.
- vi. Safe practices and near miss cases of potential accidents.
- vii. Availability factor of critical machineries & standby equipment.

6.2. The plant or any unit thereof shall be considered not available owing to the following reasons:

- i. Reasons attributable to the owner, reasons attributable to the CPP / GACL plant, and dispatches
- ii. Non availability of Raw materials like Salt, Power, Steam, Chemicals, DM water, Raw water, etc. which could hamper production
- iii. Force Majeure conditions
- iv. The written instruction/directives by the owner or any competent authority
- v. Non availability of spares etc. for the reasons attributable to the owner
- vi. Incomplete systems in the CPP/CSP/GACL
- vii. Major Breakdown of machineries involving loss of capacity, only if such an event is not attributable to the fault of O&M Operator.
- viii. Blackout or electrical line tripping causing power supply loss, not attributable to the fault of O&M Operator.
- ix. Planned scheduled Outage
- x. Action taken by O&M Operator to protect the plant as per prudent practices in specific situations arising due to the reasons not attributable the O&M Operator
- xi. Improvement period for repairs/modifications not attributable to O&M Operator.

6.2.1 Liquidated Damages / Penalties/ Bonus: The parameters and corresponding benchmarked values shall be specified after the Guarantee Test Run. The indicative list is provided below:

Sr No	Performance Indicator	Expected value	Unit	Penalty for not meeting expected value	Bonus for exceeding expectation	Remarks
1	Caustic soda production	Min 21000 Or as set forth by GNAL from time to time	TPM	@ 0.005% of Monthly O&M Fees per MT of short fall below monthly target if such short fall is in the range of 01-1000 MT and @0.006% of Monthly O&M Fees per MT of short fall if the shortfall is higher than 1000 MT for a given month	@ 0.0025% of Monthly O&M Fees per MT of additional production beyond 23000 for a given month	
Consumptions						
2	Total Power consumption (Rectifier + Auxiliary)	As per GTR.	kWh /MT	At the Rate of Rs 5.5 /KWh for the total excess power consumed	At the Rate of Rs 2.5 /KWh for the total excess power consumed	
	Efficiency	As per GTR	%	At the rate Of Rs. 60,000 /day for every 0.5% decrement in efficiency.		
		Max. expected value				
3	Salt (NaCl)	As per GTR	Kg/ MT	At the Rate of Rs 15.0 /Kg in excess of expected value	monthly basis	
4	Na ₂ CO ₃ , With BaCO ₃	As per GTR	Kg/ MT	At the Rate of Rs 30.0 /Kg in excess of expected value		
	Na ₂ CO ₃ , Without BaCO ₃	As per GTR	Kg/ MT	At the Rate of Rs 30.0 /Kg in excess of expected value		
5	BaCO ₃	As per GTR	Kg/ MT	At the Rate of Rs 40.0 /Kg in excess of expected value		

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6	HCl 100% (without brine acidification)	As per GTR	Kg/MT	At the Rate of Rs 80.0 /Kg in excess of expected value		
7	NaOH 100%	As per GTR	Kg/MT	At the Rate of Rs 55.0 /Kg in excess of expected value		
8	NaHSO ₃	As per GTR	Kg/MT	At the Rate of Rs 35.0 /Kg in excess of expected value		
9	Flocculating agent	As per GTR	Kg/MT	At the Rate of Rs 350.0 /Kg in excess of expected value		
10	Sulphuric acid	As per GTR	Kg/MT	At the Rate of Rs 10.0 /Kg in excess of expected value		
11	α – Cellulose	As per GTR	Kg/MT	At the Rate of Rs 250.0 /Kg in excess of expected valuen		
12	Steam	As per GTR	Kg/MT	Rs 1500/MT in excess of expected value		
13	DM Water	As per GTR	M3/MT	Rs 70/m3 in excess of expected value		
14	Nitrogen	As per GTR	Nm 3/d ay	Rs 2.5 /m3 in excess of expected value		
15	Plant air	As per GTR	Nm 3/d ay	Rs 1/m3 in excess of expected value		
16	Instrument air	As per GTR	Nm 3/d ay	Rs 1/m3 in excess of expected value		
17	Process Water	As per GTR	m3/day	Rs 50/m3 in excess of expected value		
By-product/wastes						
1.	Solid waste, without BaCO ₃	As per GTR	Kg/MT	Disposal in O&M scope		
2.	Solid waste, with BaCO ₃	As per GTR	Kg/MT	Disposal in O&M scope		
3.	Waste water	As per GTR	m3/day			

PENALTIES AND BONUS for PERFORMANCE INDICATORS		
Penalty @ Rs 10,000 for every occurrence of exceeding the max. value		
Brine Specification at the inlet to cells		
Performance indicator	Max. Value	Unit
NaCl	As per GTR	g/l
Ca + Mg	As per GTR	ppb w/w
Sr	As per GTR	ppb w/w
Ba	As per GTR	ppb w/w
Al	As per GTR	ppb w/w

Ni	As per GTR	ppb w/w
Fe	As per GTR	ppb w/w
Pb	As per GTR	ppb w/w
Co	As per GTR	ppb w/w
Mn	As per GTR	ppb w/w
Hg	As per GTR	ppb w/w
Heavy metals –(total of) Cr, Mo Mn, Co, Ni, Cu Zn, Cd, Pb, As, Sb	As per GTR	ppb w/w
SiO ₂	As per GTR	ppm w/w
Insoluble	As per GTR	ppm w/w
F	As per GTR	ppm w/w
I	As per GTR	ppm w/w
Br	As per GTR	ppm w/w
Organics (as TOC)	As per GTR	ppm w/w
NH ₄	As per GTR	ppm w/w
Sulphate (as Na ₂ SO ₄)	As per GTR	g/l
Chlorate (as NaClO ₃)	As per GTR	g/l
Free Chlorine	As per GTR	ppm w/w
NaOH-excess	As per GTR	g/l
Na ₂ CO ₃ -excess	As per GTR	g/l
pH	As per GTR	
S ²⁻	As per GTR	ppm w/w
H ₂ O ₂	As per GTR	ppm w/w
Temperature	As per GTR	°C

Note: Deviation from the parameters and corresponding benchmarked values achieved during the Guarantee Test Run both on upperside/ lower side may be mutually discussed between the Owner and O & M Operator. However, the final decision shall be of the owner which shall be binding to the O & M Operator.

6.3 Outage impacting Plant Operation and Operations of upstream/downstream plant

The O&M Operator should ensure reliable operation and avoid forced outage of any of the units of the plant, especially those adversely affecting operations of the upstream/downstream plants belonging to the other companies where materials like chlorine, hydrogen and utilities are being supplied, or the upstream unit like power plant.

6.3.1 Liquidated Damages:

Should there be any tripping/shut down of Major equipment within the battery limit leading to disturbance in caustic soda /Chlorine/ Hydrogen/utilities supply to other plants, causing stoppage of those plants, the O&M Operator will pay as penalty 0.5 % of Annual operator fee per such stoppage. Should such a stoppage cause a power plant outage, the penalty shall be @ 1% of Annual fees per occurrence.

6.3.2 Bonus:

In case of achieving Zero disturbance to the other Plants during a year, Incentive of 0.25% of Annual Fee shall be applicable.

6.4 The consumption of raw materials for the design capacity of NaOH production

The Benchmarking of overall productivity, quality of products, consumption of raw materials, auxiliary chemicals & utilities etc. shall be derived and finalized based on the Performance Guarantee Test Run (PGTR), which will be performed by technology supplier after commissioning. These benchmarking will be reviewed at regular interval i.e. on quarterly, half yearly and yearly basis, as mutually agreed. In normal conditions, it is expected that Caustic Soda Plant would be operated at full capacity of 800 MT per day for 350 days in a financial year. But if, due to market constraints or any other reasons not attributable to the contractor, plant is required to be operated at lower capacity, the suitable allowances shall be made in calculating the Penalty.

6.5 Housekeeping

Housekeeping and upkeep of Plant equipment is important for the safety of the plant and personnel as well for reliable operations. O&M operator to ensure that the equipment are maintained as per their basic conditions and the operating areas are free from obstacles /unwanted consumables/spares/tools etc.

6.5.1 Penalty:

Monthly audit of housekeeping condition of Plant & equipment will be done, and penalty up to INR 50,000-shall be levied for non-compliance. The said deduction will be applicable based on severity of non-compliance; the decision of the Head CSP, GNAL shall be final in this regard.

6.5.2 Bonus:

In case of Good Housekeeping, Incentive up to 25,000/- shall be applicable at the discretion of Head CSP, GNAL.

6.6 Maintenance

- i. Violation of procedures like SOP, SMP etc.
- ii. Any critical equipment trip/damage due to improper operations, poor workmanship, negligence or non-compliance w.r.t. Predictive and preventive maintenance & Condition Monitoring plan
- iii. Delay in closure of defects for more than 15 days maximum, considering severity and availability of spares.
- iv. Improper Notifications of closure & improper update of history in SAP/software installed
- v. CM (Condition Monitoring) Plan executed less than at prescribed level.

6.6.1 Liquidated Damages:

Penalty amount of up to INR 150,000/- per instance shall be applicable on non - compliance of any of the above aspects at the sole discretion of Head CSP, GNAL.

6.6.2 Bonus:

In case of full compliance, similar Incentive up to Rs. 50,000/- shall be applicable at the sole discretion of Head CSP, GNAL.

6.7 SAFETY LEVELS

6.7.1 The O&M operator guarantees and undertakes with respect to the Plant O&M staff, there shall be no time lost due to injury (LTI) reportable under prevailing labour and factory laws and regulations, caused due to accidents at the plant. For every accident at the plant resulting in the death of or injury to any O&M staff, the O&M operator shall pay to the owner as LD on account of LTI for every accident at the plant resulting in:

- a) The death of any O&M plant staff Rs. 5,00,000 (Rs Five lakhs) and
- b) Non-fatal injury to any O&M plant staff Rs 100,000/- (Rs one Lakh)

Notwithstanding any LD paid by the O&M operator, the O&M operator shall be solely responsible to compensate all workmen and other victims (or their closest surviving relative as the case may be) for any accident at the plant during the term as per provisions of applicable law. Furthermore, the O&M operator shall indemnify, defend and hold harmless the owner from any liability in this regard.

The Use of required Personal Protective Equipment is mandatory by each and every employee of the O&M contractor. Non usage of PPE by any employee will result into the Penalty/ Bonus as mentioned in para 6.7.2 & 6.7.3:

Notwithstanding anything contained contrary in this RFP, the O&M Operator shall undertake to indemnify and keep Owner indemnified against all losses, damages and other liabilities, which may arise after signing of the Contract under any law, statute, regulations or contract on account of performance or non-performance of obligations of O&M Operator thereunder and hereunder.

6.7.2 The GNAL may impose penalty as stated below for failure/ default by contractor during performance during the period of the contract.

Sr. No.	Nature of Default/ Failure	Amount of Penalty to be imposed
1	Any contract worker employed by contractor not wearing Helmet	Rs. 50.00 Per Person Per occasion
2	Any contract worker employed by contractor not using Safety Gadget issued	Rs. 50.00 Per Person Per occasion
3	Any contract worker employed by contractor not wearing Safety Shoes	Rs. 100.00 Per Person Per occasion
4	Not depositing PF , Service Tax, other statutory payments on due date	0.5% Per Week to maximum 5% of invoice value of labour cost
5	Not disbursing Wages, Bonus to workers on due date	Rs. 1,000.00 Per Day of delay
6	Deploying contract workers without License/Insurance or more than Licensed/ Insurance strength	Rs. 2,000.00 Per Day
7	Making payment of wages less than minimum wages	Rs. 10,000.00 Per instance
8	Littering or chewing paan, tobacco, smoking bidi/cigarette including electronic cigarette etc. on camera or having possession of the same or any unsafe operation.*	Rs. 200 per person per occasion. This may be doubled on each successive occasion of such default by same person

* Direct observation/ recording on camera would be treated as conclusive proof to levy prescribed fine

In case of repetition by the worker, the fines will be doubled on each instance. In case of frequent default by the worker, The O&M contractor will have to either suspend the worker or terminate his services.

6.7.3 SAFETY LEVEL BONUS

For each month of the term that the guaranteed safety level is achieved, O&M operator shall be entitled to a bonus of Rs. 25000/- per annum. The decision of GNAL management shall be final and binding to the O & M Operator.

6.7.4 The amount of penalty/ bonus collected as per clause 6.7.1, 6.7.2, 6.7.3 shall be spent for enhancing safety measures and awareness at the plant. The penalty amount to be paid by the contractors shall be in addition to the contractor's obligation under the workmen compensation mentioned in 5.23

6.9 Salt and other chemical UNLOADING RATE:

Subject to successful demonstration jointly in this regard with the owner, The O&M contractor shall guarantee unloading of trucks within the time as permitted. Any demurrages levied due to delays of unloading salt for reasons attributed to the O&M contractor will be borne by the O&M contractor

6.10 O&M Operator is also required to ensure that the following systems and parameters are maintained as per statutory requirements

- a) Emission norms with reference to SPM, SOX, NOX (CCU)
- b) Water chemistry (Including local ETP and STP)
- c) Specific water consumption
- d) Fugitive emissions from Plant

Deviations from the design norms will have to be corrected, within reasonable time, by the O&M operator at no cost to the owner. Any sort of fine on the owner due to deviation will be borne by the O&M contractor, if attributable to the O&M contractor.

6.11 The total amount of liquidated damages payable by the O&M Operator on account of non-fulfillment of all the Performance Guarantees except for safety and House keeping, shall be limited to 10 % (Ten percent) of the Yearly Operating Fee for the relevant Operating Year.

6.13 The total amount of Bonus payable by the Owner because of improvement of all the above-mentioned Performance Guarantees shall be limited to 5% (five percent) of the Yearly Operating Fee for the relevant Operating Year.

6.14 Owner may recover the liquidated damages payable by the O&M Operator from the Yearly Operating Fee payable by the Owner for the relevant Operating Year. Performance Guarantees shall be monitored on monthly basis and reconciled on annual basis as per values mentioned above.

6.15 All parameters on which the Penalty/incentives will be based on will as per the results available after the conduction of the PG test. In case the PG tests are delayed then the parameters will be mutually decided based on the average results of the six months of operation of the units until the PG test results are made available. The PG test for individual piece of equipment or package will be conducted by the OEM/Vendor in the presence of GNAL or any third party engaged by GNAL. In case of any dispute the decision of the owner will be final and binding on all concerned parties.

7. **Attachment 1: List of Bid documents**
(The list of all Bid documents to be submitted in this attachment)
8. **Attachment 2: Bid Security**
(Bid Security to be submitted in a separate sealed envelope)
9. **Attachment 3: Tools & Tackles and Software**

***FORMAT FOR LISTING OF TOOLS & TACKLES AND SOFTWARE FOR O&M**

Sr. No.	Description of Tools & Tackles and Software for O&M	Quantity	Comments
1.			
2.			
3.			

*The above tools and tackles would be brought to the site in addition to the existing tools and tackles available at GNAL's Caustic Soda Plant at Dahej, Bharuch.

10. **Attachment 4: Major Sub-Contractors Proposed by the Bidder**

FORMAT FOR LISTING OF MAJOR SUB-CONTRACTORS PROPOSED BY THE BIDDER

Sr. No.	Name and Address of Sub-Contractor	Brief Scope of Work	Comments
1.			
2.			
3.			

11. **Attachment 5: Takeover Plan**
(The bidder shall furnish a pre-commissioning, commissioning and Takeover Plan, together with complete Organogram and qualification/experience details of all key personnel. The plan shall also cover the proposed organization structure and important milestones in the process of takeover.)

12. **Attachment 6: Deviations**

FORMAT FOR LISTING OF DEVIATIONS

Sr. No.	Section No. of Bid Document	Clause No. of Bid Document	Deviation	Rationale for Deviation
1.				
2.				
3.				

Note: It is expected that bidder shall not take any deviations to the RFP. The bids with deviations having commercial implications will be rejected.

13. Attachment 7: Certificate regarding Acceptance of All Conditions

FORMAT FOR CERTIFICATE REGARDING ACCEPTANCE OF ALL CONDITIONS

We hereby confirm our compliance to provisions relating to the following clauses of RFP:

- a) The Contract shall be governed by and interpreted in accordance with laws in force in India. The Courts of Vadodara (India) shall have exclusive jurisdiction in all matters arising under the Contract.
- b) We shall, within fifteen (15) days of the Acceptance of Letter of Award(LOI), provide securities for due performance of the Contracts for ten percent (10%) of the Annual Contract Price, with initial validity up to ninety (90) days.
- c) We guarantee that the Caustic Soda Plant shall attain the Guarantees as specified in Attachment (Guarantees) six months from the date of handover of the respective unit
- d) Notwithstanding any other provisions, except in cases of criminal / gross negligence or willful misconduct, neither the We nor the GNAL shall be liable to the other, whether in Contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Owner.
- e) We shall carry out all activities required for O&M of GNAL’s Captive thermal Caustic Soda Plant at Dahej, Bharuch for period of 6 months commissioning support and 5 years’ Operating period for O&M.

14. Attachment 8: Guarantees

FORMAT FOR SPECIFYING GUARANTEES: To be filled up later

Sr. No.	Parameter	Guaranteed Value*	Unit	Comment
1	Plant availability per year	350	Days	
2				
3				
4				
5				
6				
7				
8				
9				
10				

***The Contractor guarantees that the Caustic Soda Plant shall attain the Guaranteed Values for specified Parameters. The guaranteed values must be equal to or better than the performance targets specified.**

15. Attachment 9: Bid Undertaking

Subject: Complete O&M 800 TPD CS Plant

Reference: Tender enquiry No: GNAL/O&M/2020/RFP _____

Due on date:

In connection with the above subject and reference I/ We confirm the following:

- 1. I / We, the under signed have read and examined the Tender Specifications in tender, together with all the Attachments, Annexures etc. mentioned under reference along with the commercial terms and conditions.**
- 2. I / We, declare that our Technical Bid is strictly in line with the Tender Specifications (except the deviations shown in Attachment of Technical Deviations to this tender document).**
- 3. Further, I / We also agree that additional conditions / deviations, if any, found in the terms & conditions (except deviation as per attachment of deviation), our offer shall be out rightly rejected without assigning any reason thereof.**

Seal of the Firm Signature of the Authorized

Representatives of the firm

Date:

16. Attachement 10 : INTEGRITY PACT

Date:

Over endeavor is to create an environment where Business Confidence is built through the Best Business Practices and is fostered in an atmosphere of trust and respect between providers of goods and services and their users for the ultimate benefit of society and the nation.

OWNERS COMMITMENT

- To maintain the highest ethical standards in business and professions
- Ensure maximum transparency to the satisfaction of stakeholders.
- To ensure fulfillment of the terms of agreement / contract and to consider objectively the viewpoint of parties.
- To ensure regular and timely release of payments on due dates for the work accomplished.
- To ensure that no improper demand is made by employees or by anyone on behalf of the OWNER.
- To give maximum possible assistance to all the Vendors / Suppliers / Service Providers and others to enable them to achieve the objectives in a timely manner.
- To provide all information to suppliers /contractors relating to contract / job which facilitate him to complete the contract / job successfully in time.
- To ensure minimum hurdles to vendors / suppliers / contractors in accomplishing of agreement / contract / work order.

BIDDER'S AND/OR SELECTED O&M CONTRACTOR'S COMMITMENT

- Not to bring pressure recommendations from outside to influence OWNER for its decision.
- Not to use intimidation, threat, inducement or pressure of any kind on OWNER or any of its employees under any circumstances.
- To be prompt and reasonable in fulfilling the contract, agreement, legal obligations in letter and spirit.
- To provide goods and/or services timely as per agreed quality and specifications at minimum cost to the OWNER
- To abide by the general discipline to be maintained in the dealings.
- To be true and honest in furnishing information.
- Not to divulge any information, business details available during the course of business relationship to others without the written consent of OWNER.
- Not to enter into cartel / syndicate / understanding whether formal / non-formal so as to influence the price

Seal & Signature

(Authorized Person of Owner)

(Authorized Person of Bidder)

Name:

Designation

**17. Attachment 11:
Price Schedule (1st year)**

O& M Service Charges/Month for production up to 21000 MT per Month		
Monthly Charges for operating the Plant at 21000 MT per month (or less if so determined by GNAL management)	Rs./Month	
Payment for each additional MT of Caustic Soda up to 22,000 MT per month	Rs./MT	
Payment for each additional MT of Caustic Soda up to 23,000 MT per month	Rs./MT	

Indicative break-up of Monthly Minimum Fees (for the first year)

SN	Particulars	Amount Rs/Month	Remarks
1.	Cost of Managerial manpower	XXXXXXXX	XX numbers of employees with an average rate of Rs.XXXXXXX/employee/Month
2	Cost of skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of semi-skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
4	Cost of unskilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of supporting staff	XXXXXXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/employee/month
3	Administrative expenses	XXXXXXXXXX	
3.	Other Overhead expenditures, Contingency fund and profit margin		
	Total		

Schedule of Monthly rates for the man-power

Sr. No.	Description	INR Per Month
1	Monthly rate for managers having minimum 20 years of experience	

Sr. No.	Description	INR Per Month
2.	Monthly rate for managers having minimum 15 years of experience	
3	Monthly rate for managers having minimum 10 years of experience	
4	Monthly rate for managers having minimum 5 years of experience	
5	Monthly rate for skilled workers	
6	Monthly rate for semi-skilled workers	
7	Monthly rate for unskilled workers	

Note: 1) The monthly rates for each category of work force, as mentioned above shall be applied while enhancing or reducing the supervisory/non-supervisory manpower as an adjustment after annual review, as necessary

2) The **Charges for supporting Pre-commissioning activities – till commissioning. (for about four months)** will be paid on pro-rata, on monthly basis, in proportion of the manpower deployed, considering 100% as full manpower deployment for normal O& M (For example if manpower for O &M is considered as 270, i.e. 8100 man-days for a month, and manpower deployed for a given month is “A” man-days, then the amount payable for that particular month shall be calculated as under:

$(A \times \text{Minimum Monthly Charges for the first year}) / 8100$

It is expected that the the partial manpower deployed during the pre-commissioning period would have the mix of managerial/skilled/unskilled manpower more or less in the same proportion as for the full fledge operations.

(All other taxes, etc. except GST will be inclusive in the above prices)

Price Schedule (2nd year)

O & M Service Charges/Month for production up to 21000 MT per Month		
Monthly Charges for operating the Plant at 21000 MT per month (or less if so determined by GNAL management)	Rs./Month	
Payment for each additional MT of Caustic Soda up to 22,000 MT per month	Rs./MT	
Payment for each additional MT of Caustic Soda up to 23,000 MT per month	Rs./MT	

Indicative break-up of Monthly Minimum Fees (for the second year)

SN	Particulars	Amount Rs/Month	Remarks
1.	Cost of Managerial manpower	XXXXXXXX	XX numbers of employees with an average rate of Rs.XXXXXXX/employee/Month
2	Cost of skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of semi-skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
4	Cost of unskilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of supporting staff	XXXXXXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/employee/month
3	Administrative expenses	XXXXXXXXXX	
3.	Other Overhead expenditures, Contingency fund and profit margin		
	Total		

Schedule of Monthly rates for the man-power

Sr. No.	Description	INR Per Month
1	Monthly rate for managers having minimum 20 years of experience	

Sr. No.	Description	INR Per Month
2.	Monthly rate for managers having minimum 15 years of experience	
3	Monthly rate for managers having minimum 10 years of experience	
4	Monthly rate for managers having minimum 5 years of experience	
5	Monthly rate for skilled workers	
6	Monthly rate for semi-skilled workers	
7	Monthly rate for unskilled workers	

Note: 1) The monthly rates for each category of work force, as mentioned above shall be applied while enhancing or reducing the supervisory/non-supervisory manpower as an adjustment after annual review, as necessary

Price Schedule (3rd year)

O& M Service Charges/Month for production up to 21000 MT per Month		
Monthly Charges for operating the Plant at 21000 MT per month (or less if so determined by GNAL management)	Rs./Month	
Payment for each additional MT of Caustic Soda up to 22,000 MT per month	Rs./MT	
Payment for each additional MT of Caustic Soda up to 23,000 MT per month	Rs./MT	

Indicative break-up of Monthly Minimum Fees (for the third year)

SN	Particulars	Amount Rs/Month	Remarks
1.	Cost of Managerial manpower	XXXXXXXX	XX numbers of employees with an average rate of Rs.XXXXXX/employee/Month
2	Cost of skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXX/workman/month
3	Cost of semi-skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXX/workman/month
4	Cost of unskilled manpower	XXXXXXXX	XX numbers of employees with an average cost of

			Rs.XXXXXXX/workman/month
3	Cost of supporting staff	XXXXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/employee/month
3	Administrative expenses	XXXXXXXXXX	
3.	Other Overhead expenditures, Contingency fund and profit margin		
	Total		

Schedule of Monthly rates for the man-power

Sr. No.	Description	INR Per Month
1	Monthly rate for managers having minimum 20 years of experience	
2.	Monthly rate for managers having minimum 15 years of experience	
3	Monthly rate for managers having minimum 10 years of experience	
4	Monthly rate for managers having minimum 5 years of experience	
5	Monthly rate for skilled workers	
6	Monthly rate for semi-skilled workers	
7	Monthly rate for unskilled workers	

Note: 1) The monthly rates for each category of work force, as mentioned above shall be applied while enhancing or reducing the supervisory/non-supervisory manpower as an adjustment after annual review, as necessary

Price Schedule (4th year)

O& M Service Charges/Month for production up to 21000 MT per Month		
Monthly Charges for operating the Plant at 21000 MT per month (or less if so determined by GNAL management)	Rs./Month	
Payment for each additional MT of Caustic Soda up to 22,000 MT per month	Rs./MT	
Payment for each additional MT of Caustic Soda up to 23,000 MT per month	Rs./MT	

Indicative break-up of Monthly Minimum Fees (for the fourth year)

SN	Particulars	Amount Rs/Month	Remarks
1.	Cost of Managerial manpower	XXXXXXXX	XX numbers of employees with an average rate of Rs.XXXXXXX/employee/Month
2	Cost of skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of semi-skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
4	Cost of unskilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of supporting staff	XXXXXXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/employee/month
3	Administrative expenses	XXXXXXXXXX	
3.	Other Overhead expenditures, Contingency fund and profit margin		
	Total		

Schedule of Monthly rates for the manpower

Sr. No.	Description	INR Per Month
1	Monthly rate for managers having minimum 20 years of experience	
2.	Monthly rate for managers having minimum 15 years of experience	
3	Monthly rate for managers having minimum 10 years of experience	
4	Monthly rate for managers having minimum 5 years of experience	
5	Monthly rate for skilled workers	
6	Monthly rate for semi-skilled workers	
7	Monthly rate for unskilled workers	

Note: 1) The monthly rates for each category of work force, as mentioned above shall be applied while enhancing or reducing the supervisory/non-supervisory manpower as an adjustment after annual review, as necessary

Price Schedule (5th year)

O & M Service Charges/Month for production up to 21000 MT per Month		
Monthly Charges for operating the Plant at 21000 MT per month (or less if so determined by GNAL management)	Rs./Month	
Payment for each additional MT of Caustic Soda up to 22,000 MT per month	Rs./MT	
Payment for each additional MT of Caustic Soda up to 23,000 MT per month	Rs./MT	

Indicative break-up of Monthly Minimum Fees (for the fifth year)

SN	Particulars	Amount Rs/Month	Remarks
1.	Cost of Managerial manpower	XXXXXXXX	XX numbers of employees with an average rate of Rs.XXXXXXX/employee/Month
2	Cost of skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of semi-skilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
4	Cost of unskilled manpower	XXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/workman/month
3	Cost of supporting staff	XXXXXXXXXXXX	XX numbers of employees with an average cost of Rs.XXXXXXX/employee/month
3	Administrative expenses	XXXXXXXXXX	
3.	Other Overhead expenditures, Contingency fund and profit margin		
	Total		

Schedule of Monthly rates for the man-power

Sr. No.	Description	INR Per Month
1	Monthly rate for managers having minimum 20 years of experience	

Sr. No.	Description	INR Per Month
2.	Monthly rate for managers having minimum 15 years of experience	
3	Monthly rate for managers having minimum 10 years of experience	
4	Monthly rate for managers having minimum 5 years of experience	
5	Monthly rate for skilled workers	
6	Monthly rate for semi-skilled workers	
7	Monthly rate for unskilled workers	

Note: 1) The monthly rates for each category of work force, as mentioned above shall be applied while enhancing or reducing the supervisory/non-supervisory manpower as an adjustment after annual review, as necessary

(All other taxes, etc. except GST will be inclusive in the above prices)

Seal & Signature

(Authorized Person of Bidder)

8. Annexure 1: Process Description, Block Diagram & Layout

The details provided herein are indicative only.

Overview of the plant is as under:

Caustic Soda Plant with production capacity of 800 TPD NaOH (100% Basis), 8 no. of BM2.7-214 generation 6B-40, bipolar electrolyser with 214 Elements each tkIS (Uhde) technology with NaCl salt as Raw material.

Main elements of plant include: Salt handling, Saturation, Brine Treatment, i.e. Precipitation tanks, Clarifier, Anthracite filter, polishing filters, Ion exchange columns. Anolyte handling and vacuum de-chlorination system. CL2 Cooling, Drying, Compression, Refrigeration and Liquefaction and vaporization. Waste gas de-chlorination, (Sodium Hypo Chlorite), HCl Synthesis (2 X 120 TPD). Caustic Soda Evaporation (800TPD) and Flaking (200 TPD), H₂ Cooling, Compression and Bottling. RVDF System, SRS including crystallization unit

18.0 PROCESS DESCRIPTION

18.1 Brine system

The feed to the membrane electrolysis cell is ultra-pure brine. Satisfactory operation of the Membrane Electrolysis Cells requires extremely high purity of brine. It is therefore necessary to remove all impurities from brine like Calcium, Magnesium, Sulphate and Strontium. Depleted brine from cells is recycled, saturated and purified before feeding to the electrolysis cell.

The brine treatment consists of the following process steps:

Unit 01	Salt Storage & Salt Handling
Unit 02	Brine Saturation
Unit 03	Chemical Preparation and Precipitation
Unit 04	Brine Clarification
Unit 05	Brine Filtration
Unit 06	Secondary Brine Purification
Unit 07	Anolyte De-chlorination
Unit 08	Chlorate Destruction
Unit 09	Sulphate Removal System

After the brine treatment, the brine meets the specific requirements for the electrolysis in the membrane cells.

18.1.1 Salt Handling, Brine Saturation and Precipitation

Comprising of Unit 01/02/03

Unit 01: Salt Storage & Salt Handling

Salt is stored in open type salt storage [01A001].

Raw salt is charged to Vertical brine saturators by bucket elevators and vibratory feeder. Salt storage and handling system [01U001] will be package unit.

Unit 2: Brine Saturation

The brine saturation system consists of two brine saturators [02A001A/B]. One of the saturators is in operation while the other is in standby mode. The saturator is filled with salt from the nearby salt hopper with the help of belt conveyor & tripper. The de-chlorinated lean brine containing 210-220 gpl NaCl from lean brine pump [07P001A/B] is recycled back to the saturator through dip pipe submerged under the salt bed. DM water and vapour condensate from the caustic evaporation unit is added to the lean brine to make up the water lost due to water migration through the membrane, evaporation losses from the brine system. Lean brine passes through bottom to top of the salt bed. In this process the lean brine gets saturated. The saturated brine over flows through the strainer pot [02A002], in the overflow weir into the precipitation tank [03R001A/B], where unwanted suspended material will be trapped. The concentration at the saturator outlet is generally 300 - 305 gpl NaCl.

The insolubles settle at the bottom of the saturator. These insolubles have to be removed periodically as detected by the quality of the salt by manual sampling. The sludge is removed by draining the saturators to the sludge pit [02X001]. The brine removed with sludge is recovered by Saturator sludge pit pump [02P002] which is provided with priming vessel [02D001] for the initial priming of the pump.

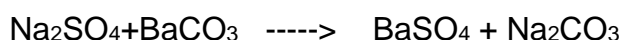
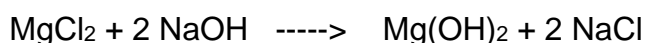
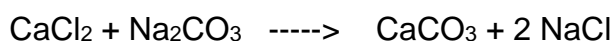
Unit 03: Chemical Preparation and Precipitation

Saturated brine from the overflow of Brine saturator is taken to the precipitation tanks [03R001A/B]. The two precipitation tanks are operated in series with the overflow from the first tank [03R001A] flows in to the second [03R001B]. The precipitation chemical 7-10 %Na₂CO₃ is added in first precipitation tank by Na₂CO₃ pumps [03P002A/B]. From the first precipitation tank the brine overflows to the second precipitation tank [03R001B] where NaOH-solution is added to the brine.

Precipitation tanks are installed with agitator [03R001A/B-N01] for agitation.

Sodium Carbonate solution, Barium Carbonate solution and Sodium Hydroxide solution are added in the tanks for the precipitation of Calcium, Sulfate and Magnesium as Calcium Carbonate, Barium Sulfate and Magnesium Hydroxide respectively.

The precipitation reactions taking place are as follows:



10% Na₂CO₃ solution is prepared separately in Sodium Carbonate tank by charging Na₂CO₃ from bag & mixing in lean brine. For lifting of the Na₂CO₃ bags electric hoist is provided [03H001]. There are two chemical tanks [03D002A/B] for Na₂CO₃ preparation. For the uniform concentration solution tanks are provided with the agitator [03D002A/B-N01]. Na₂CO₃ is fed by Na₂CO₃ pump [03P002A/B] to the

precipitation tank at a control rate. The flow rate of Na_2CO_3 is measured in a flow meter and addition is controlled via a flow control valve by controlling carbonate at the outlet of precipitation tank [03R001B] with analyzer. The same electric hoist [03H001] can also be used to lift agitator during maintenance.

7-10% BaCO_3 solution is prepared separately in Barium carbonate (BaCO_3) tank [03D001A/B] by charging BaCO_3 from bag and & mixing in DM Water / lean brine and alkaline waste brine from Alkaline waste brine tank [05D006]. There are two chemical tanks [03D001A/B] for BaCO_3 preparation. For the uniform concentration solution tanks are provided with the agitator [03D001A/B N01]. BaCO_3 is fed by BaCO_3 Solution feed pump [03P001A/B] to the precipitation tank at a control rate. Flow of BaCO_3 is controlled by a timer operated on-off valve.

18.1.2 Brine Clarification

Comprising of Unit 04

The raw brine is fed by gravity from the precipitation tanks [03R001A/B] to a conical bottom clarifier [04N001]. Before entering the clarifier, the raw brine is mixed with flocculants in a Mixing Pot [04D002]. This helps in formation of larger flock out of very fine precipitates particularly $(\text{Mg}(\text{OH})_2)$ and promotes the settling of the precipitated solids in the Clarifier. The flocculent solution is prepared by mixing flocculants and DM water with the help of agitator [04D004A/B-N01] in a flocculent agent tanks [04D004A/B] and pumped by flocculent agent metering pumps [04P004A/B] to the Mixing Pot [04D002].

In the clarifier, more than 99% of solids settle down and scrapped by the clarifier internal [04N001-Z01] towards the conical bottom. The sludge from the Clarifier underflow is pumped out to the Rotary vacuum drum filter [04F001A/B] through clarifier sludge pump [04P002A-C] and to facilitate the flocculation & settling process provision is there to recycle some percent of sludge to the precipitation tank.

The cake from the Rotary vacuum drum filter falls directly into a trolley for disposal as land filling.

The supernatant brine overflows into the clarified brine tank [04D001]. From the clarified brine tank brine is pumped to the Anthracite Filtration unit by the Clarified Brine Pumps [04P001A/B].

Provision is also made to discharge the clarifier underflow to the sludge tank [04D003] in case of an emergency. Sludge tank is equipped with agitator [04D003-N01] to keep the sludge under suspension. The Sludge Pump [04P003A/B] is used to pump this sludge to the Rotary vacuum drum filter.

18.1.3 Brine Filtration

Comprising of Unit 05

The biggest threat to sustain good performance of membranes in electrolyser cells comes from impurities in salt especially sea salt. These impurities can be removed by Ion Exchange unit if it is in dissolved state. The suspended solids cannot be

removed by the ion exchange unit and therefore has to be completely removed prior to feeding the brine to secondary brine treatment.

In view of above, a two-stage filtration system is provided:

- First stage – Anthracite Filters
- Second stage – Brine Polishing Filters for removal of the suspended solids like $Mg(OH)_2$ which escapes in the first stage.

The two-stage filtration system ensures that the brine going to secondary brine purification is virtually free of all suspended solids. Typical suspended solid concentration at polishing filter outlet is less than 0.2 NTU.

Brine Anthracite Filtration

Brine from the clarifier still contains approx. 50 ppm of suspended solids. In order to achieve a reasonable performance from the polishing filters, these solids must be removed beforehand. The removal of these suspended solids is done in the anthracite filters [05F001A-G]. Clarified brine with approx. 50 ppm suspended solids is passed through the anthracite filters [05F001A-G]. Six are in operation, while one is in backwashing mode.

The brine filters are packed with anthracite [05F001A-G-Z01] of three different grain sizes. The top layer consists of fine particles and act as the filter media. The lower layers are meant for supporting the top layer. Distribution headers are provided with perforations for uniform distribution of brine. Brine enters the filter housing from the top. By means of the clarified brine pump [04P001A/B], brine is passed through the filters and the solids are retained on the surface of the filter media. The filtrate passes through the filter nozzles [05F001A-G-Z02] to the lower part of filter housing and from there to filtered brine tank [05D001].

To remove the sludge collected over the filter media, periodic backwashing of filters is necessary.

After approximately 24 hours of operation [depending on the suspended solids content in the Clarified brine], the filter is expected to be taken out of operation for backwashing. If a filter is allowed to operate too long between two consecutive backwashes, the solids build-up may be too high which means the resistance to flow will be too high. In such a case, only a small amount of brine passes through this filter and the rest through the channel of filters. This may result in unsatisfactory filter operation.

Backwashing is done once in every 4 hours, i.e. one filter in line for 24 hours before being taken out for backwash. Exact frequency of backwashing depends upon quality of clarified brine and will have to be decided during normal operation. Backwashing is done by means of filtered brine using the backwash pump [05P004].

The filter backwash is taken to the Filter backwash recovery tank [05D007] from where it is recovered into the brine system by filter backwash recovery pump [05P007A/B].

Backwashing of brine filter is done in four steps:

- 1 Isolation
- 2 Backwash
- 3 Recycle
- 4 Normal Operations

The backwash is done automatically through sequence logic. Backwashing may also be done in manual mode by switching on and off each valve as required.

The filtered brine containing approximately less than 5 ppm suspended solids flows to filtered brine tank [05D001].

Brine Polishing

The purpose of Brine polishing unit is to remove the final traces of suspended solids from the brine prior to removal of dissolved impurities in ion exchanger. The polishing unit consists of three identical Brine polishing filters [05F002A-C], two operating and one standby.

Brine polishing system consists of two filter housings containing PP cloth filter candles. The candles are hung from a register to the shell. By means of the filtered brine pump [05P001A/B] pressure, the brine passes through the candles [05F002A-C-Z01] and the solids are retained on the outer surface. A discharge channel is installed in the upper part of the filters. The polished brine is discharged via this channel to the polished brine tank [05D002] at downstream of the filtration stage.

Due to the retention of solids on the candles, a filter cake builds up on the outer surface of the candles in the course of operation. Since the brine throughput is maintained constant, the pressure drop across the filter increases with increasing thickness of the filter cake. The pressure drop across the filter is constantly monitored. The pressure drop across the filter must not exceed 2.0 Kg/cm²g. As soon as the pressure drop approaches this value, the filter must be taken out for cleaning. Normally one filter is backwashed after 48 hours of operation depending on quality of brine.

This filter operation is by sequence –the main steps are the following:

- 1 Filling of Filter
- 2 Back washing (hose cleaning) with Air
- 3 Refilling of Filter and Homogenizing
- 4 Pre-coating
- 5 Filtration with Body feed
- 6 Draining of filter and Heel draining
- 7 Cake Drying with Air [shock method]
- 8 Pressure release
- 9 Cake discharge

After polishing filtration, HCl is added in the brine stream to dissolve precipitated fine Mg(OH)₂. Further NaOH is added to this acidic brine, before sending it to ion-exchange column for secondary brine purification.

The candle filters operate with precoat. Precoat and Body feed solution [0.5% alfa cellulose] is prepared in the Precoat tank [05D003]. Precoat solution is pump to the

filter by precoat pump [05P005] during the precoating stage, and body feed solution is mixed with the filtered brine and send to the polishing filter during filtration stage by the body feed metering pump [05P008A/B]. The candle filters are cleaned with air pressure. For the steps no. 6, 7 & 9 adequate amount of air is required so a separate air buffer vessel [05D008] is provided for this purpose.

From the polished brine tank [05D002], the brine is pumped by polished brine pump [05P002A/B] to chlorine recuperator [21E001] where the brine is heated by chlorine gas from electrolyser. From chlorine recuperator it goes to the ion exchange columns [06F001A/B] at a temperature of approx. 63-65°C

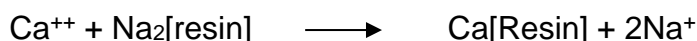
18.1.4 Secondary Brine Purification

Comprising of Unit 06

In order to warrant trouble-free operation of the membrane cells and a long service life of the membranes, the cells must be supplied with extremely pure brine. The calcium and magnesium content in the brine is not allowed to exceed 20 ppb as the deposition of these ions in the membrane affects its function and leads to an increased power consumption. Such low contents can be achieved using proven technology in special ion exchange columns.

The columns are filled with a chelating cation - exchange resin (with the help of resin transfer ejector & charging pot), with a high selectivity for calcium, magnesium and strontium ions.

The ion exchange reaction as an example for Ca^{+2} ion can be written as follows:



This reaction continues until equilibrium is achieved and the breakthrough point is reached. Then the resin must be regenerated to its original state by another ion exchange reaction using consecutively approx. 7% Hydrochloric acid and approx. 4% caustic soda solution.

Operation

The three ion exchange columns [06F001A/B/C] are used for the secondary brine purification shall be operated in marry-go-round principle. Two columns are connected in series in a "Lead / Lag" arrangement. Each column is designed for 100% full capacity of the total plant. The third column serves as a back-up column which takes over the main purification when the Lead/Lag column is being regenerated. The regenerated column then becomes the back-up column.

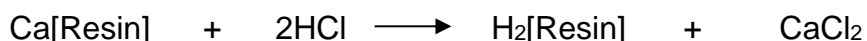
The two ion exchangers are connected in series during normal operation. If leading ion exchanger is exhausted, it is put in regeneration and conditioning mode while the third one takes over the leading position.

To ensure an easy and correct operation of these On-Off valves, a sequence control is provided in the DCS allowing both manual operations as well as automatic operation from the DCS.

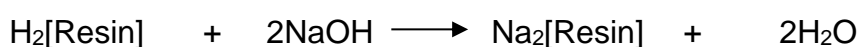
Regeneration

The resin is regenerated for approx. 5 – 6 hours at regular intervals; usually after every 72 hours depending on the Ca⁺⁺, Mg⁺⁺ level in the polished brine. The resin is regenerated with diluted hydrochloric acid and afterwards conditioned with caustic soda solution.

The regeneration of the resin as an example for Ca⁺⁺ ion can be represented as follows:



After removing the calcium from the resin, the conversion into the sodium form takes place by treating with the caustic soda solution:



During the regeneration reaction, a volume contraction of 40% of the resin in the Hydrogen form takes place. The conversion back into sodium form involves volume expansion to its original volume. After many regeneration cycles, a small portion of the resin beads will be fractured due to repeated expansion and contraction. It is expected that about 5-10% of the resin will be fractured after every 200 regeneration cycles. These fines can increase the pressure drop across the column, which causes further fracturing. This is removed from the bed by backwashing. During backwashing the flow is from bottom to top. This removes the fines by fluidization.

For regeneration, 18% caustic soda is delivered from 18% NaOH Tank [26D004] and 18% HCl delivered from the 18% HCl tank [06D005] via 18% HCl Pumps [06P002A/B]. Demineralized water is used to dilute HCl to a concentration of 7% for regeneration and NaOH to 4% for conditioning.

The regeneration procedure is fully controlled by the sequence control installed in the DCS.

The quantity of demineralized water used for regeneration purpose is quite substantial. In order to reduce demineralized water consumption and effluent quantity, alkaline part of the regeneration effluent is recovered and re-used and the acidic waste water are collected in the effluent treatment plant. Accordingly, additional facilities have been provided in piping and instrument design to recover the brine wash [i.e. brine + wash water], the back wash water.

The alkaline effluents including the caustic wash is collected in the alkaline waste brine tank [05D006] and pumped to the precipitation tank / lean brine pump suction by alkaline waste brine pump [05P006A/B].

The pure brine after secondary purification goes to the electrolyzers via Brine Heat Exchanger - I [06E001] by passing pure brine head tank [06D001]. Brine Heat Exchanger – II [06E002] is used for cooling the brine in case of shutdown and cooling of electrolyzers.

Brine Conditioning

For optimum performance of electrolyzers, electrolyzers must be operated at a specified temperature. So, the brine and caustic are fed to the electrolyzers must be at a specific temperature. The exact temperature however depends on the plant load, condition of membrane and coatings.

The brine after Ion exchanger passes through Brine Heat Exchanger - I [06E001] where the temperature is raised to around 75°C.

Need for brine heating shall depend on the load of cells. A temperature indicator controller is provided at the outlet of Brine Heat Exchanger – I [06E001] to ensure that the brine is at the correct temperature.

Steam is used in [06E001] to raise the temperature of brine. Steam pressure is reduced to approximately 1 kg/cm²[g] by a pressure control valve, prior to feeding to heat exchanger. The superheated steam from pressure control valve is re-saturated by adding demineralized water through temperature controller.

Heating is necessary mainly for start-ups and low loads.

At the time of shutdown, it is necessary to cool the cells by feeding cold brine and caustic. Hence, Brine Heat Exchanger – II [06E002] is used as a cooler and cooling is carried out by means of cooling water.

Brine from the heat exchanger [06E001 / 06E002] goes to Electrolyser bypassing pure brine head tank [06D001] from where the brine flows to the electrolysis cells. To ensure a steady flow to the electrolyzers, pure brine pump pressure is controlled by VFD & the head tank is allowed to overflow continuously to the polished brine tank. The overflow must be kept bare minimum to reduce the sucking in of air and dust by overflowing brine.

32% HCl is diluted to 18% HCl by adding demineralized water. Flow of DM water is ratio controlled depending on the flow of 32% HCl. 18% HCl pump [06P002A/B] transfers 18% HCl from 18% HCl tank [06D005] to electrolyzers brine feed inlet for acidification of feed brine, and other plant consumers i.e. ion exchange columns, polished brine tank and neutralization tanks.

18.1.5 Anolyte De-chlorination and Chlorate Decomposition

Comprising of Unit 07/08

The depleted brine from cells flows to anolyte tank [07D001].

The anolyte coming from the cells is chlorine saturated. Before the brine is resaturated and purified, the brine must be totally de-chlorinated. For this a two-stage de-chlorination system is foreseen.

First Stage : Vacuum De-chlorination

In the first stage chlorine is desorbed by means of vacuum, the remaining concentration of chlorine being about 10 – 30 mg/l.

Second Stage: Chemical De-chlorination

The free chlorine is chemically destroyed by means of Sodium Bisulphite [NaHSO₃]. The NaHSO₃ solution is added in a slight excess of approx. 10 – 15 ppm to ensure no chlorine is passing to the process steps downstream. In case of presence of free Cl₂ in brine, the resin in ion exchanger will be damaged.

The anolyte leaving the cells at a pH value of approx. 2.5 – 4 is monitored by pH-analyser with logic sequence. For de-chlorination and hypochlorite destruction, the pH must be reduced to approx. 2.0. The solubility of chlorine also reduces by the addition of the acid. This is achieved by adding 18% HCl from the 18% HCl tank [06D005] VIA 18% HCl pump [06P002A/B]. The addition is through a nozzle, which ensures proper mixing. The addition is also controlled by pH analyser. Acidified anolyte flows into the anolyte tank [07D001].

Anolyte Drain Vessel [07D005] is provided for draining of electrolyzers. The anolyte from the anolyte drain Vessel can be returned to the anolyte header by means of anolyte recovery pump [07P005].

The acidified anolyte is pumped to de-chlorination tank [07D002] by means Anolyte Pumps [07P006A/B]. De-chlorination tank [07D002] operates under vacuum, which is maintained by vacuum pump [07P004A/B]. This vacuum pump is equipped with vapour condenser [07E001] and condensate separator [07F002]. Under reduced pressure, the acidified anolyte is allowed to boil in the de-chlorination tank. This reduces the solubility of Cl₂ in brine and thereby causes desorption of Chlorine gas. The water content in the Chlorine gas is reduced in the vapour condenser [07E001] and separated out in condensate separator [07F002]. The condensate is returned back to the inlet of de-chlorination tank.

The wet chlorine gas from the Condensate Separator are sucked by vacuum pump and then sent to the chlorine header.

Normally, only one vacuum pump is in operation & other as stand-by.

Anolyte leaves the de-chlorinator with approx. 10 – 30 ppm free Cl₂. Caustic Soda is added to anolyte to raise the pH to approx. 8.5. This is necessary because too low a pH may result in dissolution of silica in the saturation pit. Sodium Bisulphite is added for chemical destruction of any residue of chlorine in lean brine.

Both, Caustic soda and Sodium bisulphite are added via two-flow control valves each that work with gap control in a split range to ensure good control characteristic over a wide range of volume flows. The set point for the flow control of caustic soda added to the lean brine is determined by pH-measurement of lean brine at pump discharge. The quantity of Sodium bisulphite added to the lean brine is determined by measurement of redox [level of excess bisulphite] of lean brine. A too high redox can result in escape of free Cl₂ in lean brine.

The gap control ensures that the smaller control valve of the split range is always kept in a good working position [i.e. 30-70% opening] by adjusting the bigger control valve of the split range.

The sodium bisulphite needed for de-chlorination is added as a 7% solution from Bisulphite head tank [07D003]. The sodium bisulphite is transferred to the head tank

by Bisulphite filling pump [07P003] from bisulphite preparation tank [07D004]. Caustic soda is added from caustic tank [26D004].

The physically and chemically de-chlorinated lean brine is pumped to saturators using Lean Brine Pumps [07P001A/B]. The flow of Lean Brine to saturators is controlled by VFD in lean brine pump depending on the level in the De-chlorination Tank.

Chlorate Decomposition

Electrochemical side reactions in the cell generate chlorates. As the electrolyte recirculates, a chlorate destruction unit is required to prevent the accumulation of NaClO₃ in the anolyte-system. In order to maintain a chlorate concentration of less than 10 gpl measured as NaClO₃, a chlorate destruction unit is provided.

This unit destroys the Sodium Chlorate by chlorate and hydrochloric acid reaction.



The amount of HCl added is controlled by the flow of acidified anolyte to the anolyte system, which in turn is controlled by pH-value of anolyte in anolyte header. The chlorine generated in the chlorate decomposition tank is transferred to the chlorine header.

A good reaction efficiency (above 80%) is achieved at temperature above 90°C and at HCl concentration not less than 20 gpl in brine. It is very important to analyse the HCl concentration in brine at regular intervals to ensure HCl conc. of more than 20 gpl in brine. At lower HCl concentrations, the reaction between chlorate and HCl can form ClO₂, which is explosive.

The side reaction that occurs is:



While ratio controller automatically supplies excess HCl required, excess HCl content in the Chlorate destruction tank [08D001] must be analysed to avoid the hazardous side reaction.

For the chlorate destruction, a part of the anolyte stream is sent to anolyte suction vessel [08D002]. Chlorate is decomposed by addition of hydrochloric acid. Acidified brine further sent to chlorate decomposition tank [08D001]. Acidified lean brine pump is circulated by acidified chlorate feed pump via acidified anolyte heater [08E001] where it is heated up to 90°C and goes as driving stream to acidified brine suction jet and sucks fresh acidified brine from suction vessel to chlorate decomposition tank. HCl is added in excess 20-25 gpl acidity at the outlet of chlorate decomposition tank. Acidified lean brine from the chlorate decomposition tank is used for acidification of anolyte. Acidification can be carried out direct by acidification in anolyte header when chlorate decomposition unit is not in line. The chlorine goes to main chlorine header.

Heat for chlorate destruction is supplied indirectly by LP steam at 1.0 kg/cm²(g) through a heat exchanger [08E001] and steam flow is controlled by a temperature

controller mounted on the chlorate pump discharge [08P001A/B]. Low temperature in the Chlorate decomposition tank favours the formation of ClO_2 .

Seal Water Recovery System

Seal water from all pumps is recovered and collected in seal water collection tank [07D007]. Seal water recovery pump [07P007A/B] is used to pump the seal water to lean brine pump discharge.

Steam Condensate Recovery System

Steam condensate from brine and catholyte heat exchangers are collected in steam condensate recovery tank [07D008]. Steam condensate pump [07P008A/B] is used to pump the steam condensate to battery limit.

18.1.6 Sulphate Removal System

Amount of sulphates in brine keeps on accumulating and if not reduced then exceeds the maximum limit for the safe operation of the membrane plant so a part of lean brine from Lean Brine Pump discharge is sent to the Nano-filtration unit (SRS package unit) [09U001A/B].

This Nano-filtration unit is an integrated package based on the principle of Nano-filtration.

The Lean Brine passes through the Lean Brine Cooler [09E001] where it is cooled to 60°C by the Nano-filtration Unit Permeate in the First Stage. In the Second Stage, the Lean Brine is cooled to 45°C by means of Cooling Water. 32% HCl from the 32%HCl Pumps [52P001A/B] is added to the Lean Brine coming from Lean Brine Pump [07P001A/B] to maintain the pH between 6.5 and 8.5. The cooled Lean Brine then goes to the Activated Carbon Filter [09F001A/B], which is filled with Activated Carbon which is supported with the help of Filter Nozzles. The Activated Carbon Filter is used to trap any Free Chlorine. The Lean Brine devoid of free Chlorine then passes through the Lean Brine Filter [09F002A/B], which traps any entrained Activated Carbon Particles, which may have been carried over with the Lean Brine from the Activated Carbon Filter. The Filtered Lean Brine is stored in the Filter Feed Tank [09D001] from which it is then passed through the Sulphate Removal System's Nano-filtration Unit the Permeate from the Nano-filtration Unit cools the incoming Lean Brine part stream in the Lean Brine Cooler and is then sent to the Brine Saturator [02A001A/B] and 32% NaOH is added via pH control.

The Reject Stream from the Nano-filtration Unit is sent to battery limit.

NOTE: This scheme needs to be confirmed by the Nano-filtration unit (Sulphate Removal System) Package Supplier.

18.2 Electrolysis

Comprising of Unit 11/12

To produce the capacity to 800 MTPD NaOH 100%, 8 nos. electrolyzers [11A001A-H], each having 214 elements [provision for addition of 5 elements in each electrolyser in future], are installed.

Brine from pure brine pump discharge pumped into the anode chamber of the electrolyser cells by passing pure brine head tank [06D001]. Part of the pure brine pumped to the overhead tank and recycled back to pure brine tank to keep the pure brine in hot condition. This head tank serves as a buffer to fill the electrolyser with pure brine in case of tripping of electrolyser. The brine flow to each electrolyser is adjusted by flow control valves according to the individual load and indicated by means of magnetic flow meters, which also trigger off an electrolyser trip in case of very low brine flow. HCL from 18%HCl tank feed to feed brine of electrolyser before feed brine strainer to acidify feed brine, which also trigger off electrolyser trip in case of very high flow of acid.

The cathode chamber of the electrolyser cells similarly receives weak caustic from the catholyte pump bypassing catholyte head tank [31D001]. This head tank serves as a buffer to fill the electrolyser with caustic in case of tripping of electrolyser. The caustic flow to each electrolyser is adjusted by flow control valves according to the individual load and indicated by means of magnetic flow meters, which also trigger off an electrolyser trip in case of very low caustic flow. The anode and cathode chambers of the cells are isolated from each other by the membrane, which is selective to the migration of Na⁺ ions. Water to the extent of about 34.0moles/mole of Na⁺ also diffuses through the membrane from the anode chamber to cathode chamber. Cl₂ is liberated at the anode surface and the brine in the anode compartment is depleted to approx. 210 - 220 gpl NaCl. The two-phase mixture of depleted brine and chlorine overflows from the anode chamber via an insert pipe into the anolyte header [11001A-H Z05].

As a result of the electrochemical reactions taking place in the cathode chamber, H₂ is generated at the cathode surface and OH⁻ ions combine with the Na⁺ ions, which have diffused through the membrane. A two-phase mixture of 32%-33% NaOH and hydrogen overflows from the cathode chambers into the catholyte header [11001A-H Z04]. Water required for cathodic reaction is partly supplied by the water transport through the membrane and the rest is made up by addition of demineralised water to the catholyte circulation.

Secondary electrochemical reactions result in the formation of sodium chlorate, sodium hypochlorite and oxygen.

Due to secondary electrochemical reactions and OH⁻ migration through the membrane, the current efficiency on both anode and cathode side decreases. These OH⁻ ions produce chlorate, hypochlorite and O₂ in the anode compartment. In order to obtain high purity of Cl₂, the OH⁻ ions must be neutralized before they can form O₂. This is done by addition of 18% HCl from 18% HCl Pumps 06P002A/B to brine feed to cells. Acidity in excess may convert the anode side of the membrane to H⁺ form and reduce its electrical conductivity. This damages the membrane when current is supplied. To avoid this, pH of feed brine must be carefully monitored and controlled.

A differential pressure of about 200 mmWC is maintained across the membrane. The chlorine header pressure is controlled to about 3500 mmWC[g]. The hydrogen header pressure is maintained 200 mmWC higher than the chlorine header pressure by means of a differential pressure controller. Excessive pressure in the chlorine header is avoided by relieving the gas to the waste air system. Similarly, excessive

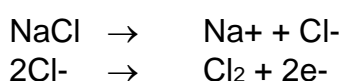
pressure in the hydrogen header is prevented by gas relief to the stack. The cells are further protected against overpressure by means of by-pass valves located on the anolyte and catholyte headers of each electrolyser.

Temperatures in the anolyte and catholyte compartment are kept constant at 88°C by means of adjusting the respective feed temperatures.

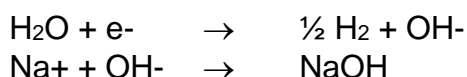
For safety reasons automatic nitrogen flushing for anolyte/chlorine header and catholyte/hydrogen header of the electrolysers is provided during shut down and startup of an electrolyser.

The main electrochemical reactions taking place within the Electrolyser cells are as follows:

Anode:



Cathode:



Cell Workshop

A cell workshop meets the requirements for the assembly and disassembly of the cells.

Pre-treatment of Membranes

The membranes are transported fully conductive i.e. in the sodium form as received. Prior to mounting the membranes in the cell elements, a pre-treatment is necessary to fully expand the membrane and to prevent undesirable wrinkles.

Moreover, the membranes are kept well moistened until the cells are put into operation by filling ½ of alkaline DM water into both the anolyte and catholyte compartment hose and sealing all 4 nozzles of the element. Hence, the “single element” technology uniquely allows the storage of ready-to-use elements.

Exchange of Cell elements

An exchange of single elements in the electrolyser may be necessary due to:
Schedule exchange of membranes

Schedule recoating of electrodes

Unexpected problems of a single element like high voltage, leakage, etc.

The following procedure applies to exchange elements in an operating electrolyser:

The concerned electrolyser has to be cut off from the current circuit by built-in switches. The other electrolyser remains on-line. Subsequently, the concerned electrolyser is cooled down to approx. 40°C by supplying cold feed brine and caustic via the heat exchanger for a single electrolyser line.

Due to this flushing and cooling, the diffusion phenomena are significantly reduced and meanwhile, chlorine and hydrogen are removed from the cells.

Prior to taking out a single element, the concerned electrolyser is drained. Then, the relevant contact pressure springs and individual flange connections to the feed and discharge lines are loosened and the concerned element is taken out, transported to the neighbouring cell workshop, and exchanged by a preassembled spare element.

Eventually, the electrolyser is refilled with brine and caustic of approx. 40°C and after heating up, the electrolyser can be again energized.

The overall downtime of an electrolyser to exchange an element – including cooling down and heating up – amount to approx. 8 – 10 hours. Two persons are required for the mechanical work.

18.3 Catholyte System

Comprising of Unit 31

The two phase mixture of 32% NaOH and hydrogen coming from the catholyte compartments of the electrolysis cells gets mostly separated in the catholyte header itself. Further 32% NaOH flows to catholyte tank [31D002].

The catholyte from catholyte tank is pumped by [31P001A/B] to the electrolyser/head tank via the catholyte heat exchangers [31E001A/B]. The catholyte pump [31P001A/B] discharge going to electrolyser is split into two lines before entering the catholyte exchangers:

One line circulates catholyte through catholyte heat exchangers [31E001A] for heating.

Another circulate catholyte through exchangers [31E001B] for cooling and combines with Catholyte Heat exchanger [31E001A] outlet before flows to the electrolyser bypassing catholyte head tank [31D001].

The temperature of combined stream to electrolyser is controlled by temperature controller by adjusting flow through the catholyte heat exchanger [31E001B]. Temperature control of feed caustic to cells is required to ensure operation of cell within specified temperature limits.

The temperature to the catholyte pump discharge is regulated so as to achieve the catholyte outlet temperature at outlet of electrolysis cells of about 88°C. Under full load this means cooling of the catholyte because of the heat developing within the electrolysis cells, under low load of the electrolysis cells this implies heating of the catholyte.

Part of the catholyte from outlet of heat exchangers is withdrawn for internal consumption and as product to Intermediate Caustic Storage Tank. In normal operation, [31E001A] shall be used for heating catholyte to cells and [31E001B] shall be used for cooling of caustic for internal consumption and as product.

Level of catholyte in catholyte tank [31D002] is controlled by controlling withdrawal of caustic to intermediate storage. Provision is also made for transferring of hot caustic to caustic concentration plant.

Catholyte heat exchangers [31E001A/B] are also used for heating / cooling of catholyte during start up / shut down of a single electrolyser.

The catholyte flowing to the cells via catholyte pump bypassing the Catholyte Head Tank is diluted by adding demineralised water via flow control.

Approximately 10% of the catholyte entering the electrolyser passed through catholyte head tank [31D001] is constantly overflowing to the catholyte tank [31D002]. This ensures that the catholyte head tank is always completely filled and hot condition. This volume is needed in order to flush the electrolysis cells in case of a major shut down. For this reason, a level indicator is provided at the catholyte head tank to switch off the rectifiers in case the level of the catholyte head tank falls below the critical limit.

Catholyte Drain Vessel [31D005] is used for draining of electrolyzers. The catholyte from the catholyte drain Vessel can be returned to the catholyte header by means of catholyte drain pump [31P005].

18.4 Chlorine System

Chlorine Cooling & Drying

Comprising of Unit 21

The chlorine gas saturated with water leaves the electrolysis cells at an overpressure of 3500 mmWC[g] and a temperature of 88°C. The chlorine gas exchanges heat with polished brine in the chlorine recuperator [21E001]. The chlorine is cooled down whereas the polished brine is heated.

Chlorine gas from the chlorine recuperator enters the Chlorine cooler [21E002], where it is cooled to 40°C by cooling water. The Cl₂ from chlorine cooler [21E002] then enters Chlorine Chiller [21E003] where it is cooled to approx. 15°C by chilled water. From the chlorine chiller the chlorine gas enters the Wet Chlorine Filter [21F001]. The function of this filter is to separate brine mist [aerosol] carried along with the gas. The filter is equipped with candles of glass fibres [21F001-Z01]. Demineralised water is sprayed into the Cl₂ stream at the filter inlet to prevent any crystallization of NaCl on filter surface and consequent increase in pressure drop.

The NaCl from the brine mist would form Na₂SO₂ and crystallise in the drying tower, if not effectively separated in the filter.

An under pressure safety vessel [21D001] is provided between the chlorine recuperator and the cooler to protect membranes against too low chlorine pressure.

The chlorine condensate from the recuperator, Chlorine Cooler, Chlorine Chiller, Wet Chlorine Filter and Under pressure safety vessel flows to a condensate collection header from where it is fed to inlet of de-chlorination tank. Wet chlorine gas from wet chlorine filter goes to Cl₂ Drying unit and part stream to HCl synthesis unit as per requirement. At the outlet of wet chlorine filter, cell pressure control valve is provided with a back flow protection to protect electrolyser.

Chlorine Drying

The gas leaving moist Cl₂ filter is dried using 98% H₂SO₄ in a drying tower [21C001A/B]. The drying tower consists of a tunnel tray section and a packed section [21C001A/B-Z01]. 98 % H₂SO₄ is fed to the topmost tray by means of 98% H₂SO₄ feeding pumps. The acid gets diluted to 78% and 78% H₂SO₄ is continuously circulated over the packed section by circulating pump [21P001A-D]. The heat of dilution is dissipated using chilled water in cooler [21E004A/B], which are installed in the recirculation line.

78% H₂SO₄ produced during the drying process transferred into the 78% H₂SO₄ day tank [21D004]. This H₂SO₄ is further pumped by 78% H₂SO₄ transfer pump [21P004] to the 78% H₂SO₄ storage tank [21T001].

98% H₂SO₄ required for drying is stored in 98% H₂SO₄ storage tank [21T002] and transferred to 98% H₂SO₄ day tank [21D002] & further pumped to drying tower using 98% H₂SO₄ feeding pumps [21P002A/B] through heat exchanger [21E005]. The cooling media used is chilled water.

[21P003A/B] pump is used for unloading 98% H₂SO₄ to storage tank [21T002] & to transfer to day tank. [21P003A/B] pump is used for 78% H₂SO₄ loading from storage tank [21T001] to tankers.

Chlorine gas leaving the drying tower has a moisture content of maximum 10 ppm w/w.

Dry Chlorine Filtration

Chlorine gas is further passed through dry chlorine filter [21F003] to completely make Chlorine gas free of entrained H₂SO₄ by trapping at the filter candles [21F003-Z01] before sending it to chlorine compressor. Trapped H₂SO₄ is collected back in 78% H₂SO₄ day tank.

18.5 Chlorine Compression, Liquefaction and Pumping

Comprising of Unit 22/23/25

Dry Cl₂ gas from dry chlorine filter enters suction side of chlorine compressors at around 1.06 bar(a) & 15 °C and is compressed about a pressure of 3.5 kg/cm²[g] at 40 °C in a three stage single centrifugal chlorine compressor [22U001] running. After every compression stage, compressed gas is cooled to prevent excessive outlet temperature by cooling water. The compressed chlorine is sent to chlorine liquefaction unit.

Recycling the chlorine gas from compressor discharge to suction the suction side controls suction pressure.

Anti-surge control protects the compressor from surging. Both the suction as well as discharge pressure of the compressor is controlled which means the compressor can operate at constant through put.

Chlorine Liquefaction

Liquefaction of chlorine is accomplished in refrigeration unit for chlorine liquefaction [23U001]. The compressed & dried chlorine gas from compressors is sent to the liquefier [23E001],. Sniff gas from the liquefier containing inerts and unliquefied chlorine is sent to the HCl synthesis unit under pressure. Excess sniff gas, if any, is diverted to the waste air de-chlorination system.

Chlorine Storage & Filling

Liquid chlorine from the liquefaction unit is taken to buffer vessel [25D001], from buffer vessel liquid chlorine is pumped by liquid chlorine pump [25P001A/B] to Chlorine filling station [24Z001A-J] or Over flow of buffer vessel will go to Cl₂ storage tank [24T001A-E]. From Cl₂ storage tank Cl₂ is filled by pressuring with Cl₂ unloading air pressure through chlorine filling station [24Z001A-L] in Cl₂ tonner / cylinder. Filling of the liquid chlorine is monitored by load cell [24W001A-L]. Expansion vessels [24D001, 24D005 and 24D008] are provided in the liquid chlorine lines at regular intervals to withstand any type of thermal shock in the system. In case of emergency due to chlorine leakage evacuation to be done by two waste air blowers, one in storage area [24K001] and one in filling station area [24K002]. EOT cranes [24H001-3] in the filled cylinder shed helps in smooth handling of the filled & empty cylinders. Liquid chlorine can be trapped in Liquid chlorine traps [24D002 & 24D006] if any liquid chlorine passed to the waste air line with a low temperature alarm in DCS.

Chlorine Evaporation System

Liquid chlorine from Cl₂ storage tank [24T001A-E] flows into the chlorine evaporator [25E001], which uses ethylene glycol to vaporize the chlorine. The Ethylene glycol system comprises tank [25T001], pump [25P002A/B] and Ethylene glycol heat exchanger [25E003]. Chilled water is used in 25E003 which is circulated through the tubes of the chlorine evaporator. Chlorine gas leaves the evaporator at about 6.6°C and is superheated in the chlorine super heater [25E002] at about 20°C, again using cooling water.

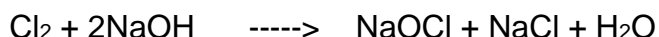
Chlorine gas leaving the super heater is sent to Battery limit.

18.6 Waste Gas De-chlorination and Bleaching Lye Storage

Comprising of Unit 26/27

All chlorine bearing waste streams from the plant are led to the waste air de-chlorination system, where it is rendered free of chlorine by scrubbing with caustic solution to produce sodium hypo. The de-chlorination is carried out by scrubbing the gases with 18% NaOH solution in a 2-stage jet scrubber.

Chlorine bearing waste air from plant is absorbed by Ejector-1 [26 F001] (first stage) and then by Ejector -2 [26F002] (second stage). The discharge from first stage goes to second stage followed by final absorber [26C001].



During start-up of electrolysis, the produced chlorine gas is sent to the waste gas de-chlorination unit until adequate Cl_2 purity is achieved. In case of emergency the system has the capacity to absorb total chlorine production at full load for approx. 10 mins. Nevertheless interlocks are provided to limit this period. The waste gas from plant is sent to the suction side of the first stage Jet Scrubber [26F001] respectively. The circulating bleach lye serves as the driving medium. About 90% of the chlorine is absorbed in the first stage. This bleach lye is drawn from the suction tank [26D001] by means of the bleach lye circulation pump [26P001A/B]. The bleach lye is cooled by bleach lye coolers [26E001] where the heat of absorption is withdrawn. The caustic soda required for absorption is introduced to the final absorber [26C001] and is overflowing via suction tank II [26D002] to suction tank I [26D001] (counter current to the flow waste gas). For ejector [26F001] the fresh NaOH is directly fed at suction of bleach lye circulation pump [26P001A/B] whenever required. When an emergency situation arises in any case, additional NaOH can be supplied from the NaOH head tank [26D004]. Excess bleach lye overflows from the suction tank I [26D001] to the bleach lye day tank [26D005].

Cooled bleach lye is circulated and sent at the inlet of bleach lye ejector [27F001]. Dry Chlorine gas from chlorine compressor mixed in bleach lye ejector [27F001] to produce required strength of sodium hypo chlorite.

Bleach lye is transferred to bleaching lye storage tank [27T001 A-B] by bleach lye transfer pump [26P003A/B].

Bleach lye is stored in Bleaching lye storage tank [27T001 A-B]. Temperature of bleach lye in storage tank is controlled by using bleach lye cooler [27E001] using chilled water as cooling medium.

The unabsorbed gases from the first stage jet scrubber are drawn into the second stage ejector [26F002] where it encounters circulating bleach lye with a high excess of NaOH by means of bleach lye circulation pump [26P001C/D]. The NaOH required for the second stage is supplied from the outlet of the final absorber [26C001].

The unabsorbed gases from the second stage jet scrubber are polished in the final absorber by circulating a part of bleach lye from pump [26P001C/D] and fresh NaOH-18% solution make-up, fed from the NaOH 18% head tank [26D004].

NaOH 18 % solution is prepared from NaOH 32 % & DM water inline and heat of dilution is removed by using cooling water in caustic cooler [26E003].

Safety philosophy of the waste gas de-chlorination system:

- The unit is designed for normal and emergency operation. In the latter case, it is able to absorb the full cell room production rate for a maximum of 10 min. by feeding caustic to the system. During normal mode, it is capable to continuously absorb the 0.3% of the total Cl_2 production.

- All chlorine bearing waste gases are connected to the de-chlorination system.
- The system is less sensitive to mechanical troubles.
- In case of a running circulation pump trip for the first absorber, the common standby pump is started in Auto mode.
- The waste gas de-chlorination system is also connected to the emergency power system. This ensures a safe operation and shut down of the plant even during a complete power failure.

In case of a power failure, caustic soda directly flows from Emergency Caustic Tank [26D006] into the second stage ejector [26F002].

18.7 Caustic Evaporation (Package Unit) and 48 % caustic storage

Comprising of Unit 32/33

The 32% NaOH coming from Cell is sent to the triple effect evaporation unit [32U001] by Intermediate Caustic Transfer pumps [31P002A/B]. The unit is designed for 800 TPD 100% NaOH as 48-49% solution production. NaOH is concentrated from 32% to 48-49% in triple effect evaporation unit and stored in 48% Caustic Soda Storage Tanks [33T002A-D].

48% caustic soda from caustic evaporation unit is stored in 48% Caustic soda storage Tank [33T002 A-D] from where it pumped by [33P002A/B] to tanker.

48% caustic soda transfer pumps [33P001A/B] to Ch-17 are used to transfer 48% caustic soda to CH-17 battery limit.

A part stream from Caustic Evaporation unit equivalent to 200 TPD (100% NaOH) is transferred to Caustic Flaking unit [32U002].

18.8 Hydrogen system

Comprising of Unit 41

Hydrogen gas leaving the cells is at a pressure of about 3700 mmWC and a temperature of 88°C. The gas is saturated with water vapour at these conditions and is cooled to remove water in Hydrogen Cooler [41E001], to approx. 40°C using cooling water. The gas is further cooled down to 20 0C in the Hydrogen Chiller [41E002] using the chilled water. The cooled gas is passed through a Hydrogen Filter [41F001] to remove the NaOH aerosols at filter candles [41F001-Z01]. If needed, the hydrogen can be simply vented through a stack equipped with flame arrestor and provided with a steam snuffing connection.

Filtered hydrogen gas from buffer vessel-I [41D002] is sent buffer vessel-II (41D003) through differential pressure control valve for controlling cell house operating pressure. Hydrogen to HCl unit is supplied through buffer vessel-II to prevent cell pressure fluctuation.

Hydrogen from buffer vessel-II is sent to hydrogen gas holder after reducing pressure by pressure control valve. Hydrogen from Hydrogen buffer vessel-III is compressed by Hydrogen compressor [42K001A-D] up to 6 kg/cm²[a] pressure and passed through De-Oxo unit (42U001) to GNAL battery limit.

Also Hydrogen from Hydrogen gas holder is compressed by Hydrogen compressor [42K002A/B] and sent to hydrogen bottling.

18.9 HCl Synthesis Unit (package unit) and HCl storage

Comprising of units 51 & 52

HCl is produced by burning hydrogen and chlorine in furnace [51U001A/B/C] and absorbing the resulting combustion gases in water in integrated falling film absorber and a scrubber column to yield a 32% HCl solution. The Cl₂ requirement is met via the liquefier sniff gas and Wet chlorine from outlet of wet chlorine filter.

Hydrogen is supplied in excess of the stoichiometric requirement and comes from the cells after cooling and filtration. Hydrogen is fed to the synthesis unit under ratio control in proportion to the Cl₂ feed. DM water feed is via flow control.

The HCl produced is collected in the HCl receiver tank from where it is pumped to the HCl storage tanks [52T001A/B] or transferred to the internal consumers within plant by HCl pump for internal consumption [52P001A/B]. From storage tank HCl is filled in tankers and Carboys by the pump [52P002A/B/C].

Two units will also have provision to produce Wet HCl gas by burning hydrogen and chlorine in furnace (51U002) and sent to battery limit.

18.10 Effluent Treatment

Comprising of unit 81

a) Solid Wastes

The plant is expected to produce solid waste containing 50% mainly consisting of, calcium carbonate & magnesium hydroxide. As this sludge does not contain any toxic mercury compounds, it can be disposed off as land fill.

b) Liquid Effluents

The liquid effluent of the plant will be primarily the acidic wastes produced during secondary brine purification. Liquid effluents are collected in the neutralisation tanks [81D001A/B]. One tank is used for neutralising the effluent and the other tank is used for collection of effluent, in alternate cycles. Neutralisation is done by HCl or NaOH. After neutralization of waste water is pumped to B/L. The alkaline wastes produced during secondary brine purification are recycled back to process.

c) Gaseous Effluents

All chlorine bearing waste gases produced both during normal operation and in case of emergency is led to the waste air de-chlorination system where they are scrubbed with NaOH solution to produce sodium hypochlorite.

18.11 Utilities

18.11.1 Demineralised Water

Comprising of Unit 73

DM water made available from B/L is stored in Demineralized water tank [73T001] and pumped to the consumers with pump [73P001A/B/C]. Normally 1 pump will be operating and one standby. The third pump is started when secondary brine regeneration is to be done.

18.11.2 Chilled Water Plant (package unit)

Comprising of Unit 74

Water is chilled to 10 DEG C in the Vapour Absorption type chilled water unit (74U001A/B). Chilling unit works on the principle of vapour absorption.

Chilled water is stored in the tank (74T001) and circulated by the chilled water pumps (74P001A/B).

18.11.3 Nitrogen Generation System

Comprising of Unit 77

Nitrogen required is generated in Nitrogen generation unit [77U001]. Nitrogen generation unit is considered along with the air compressor. Gaseous nitrogen, generated by PSA method from this unit is stored in a Nitrogen Receiver [77D001]. From this receiver, nitrogen is supplied to all the internal consumers, Electrolyser & HCl synthesis area.

18.11.4 Chlorine Unloading Air System

Comprising of Unit 78

The chlorine unloading air is produced in Chlorine Unloading Air System [78U001]. Chlorine Unloading Air System is considered along with the air compressor and dryer. Chlorine unloading air generated is sent to chlorine unloading Air Receiver [78D001]. Chlorine unloading air is used for pressurization of filled chlorine storage tank and for unloading the same to chlorine tonners/cylinders.

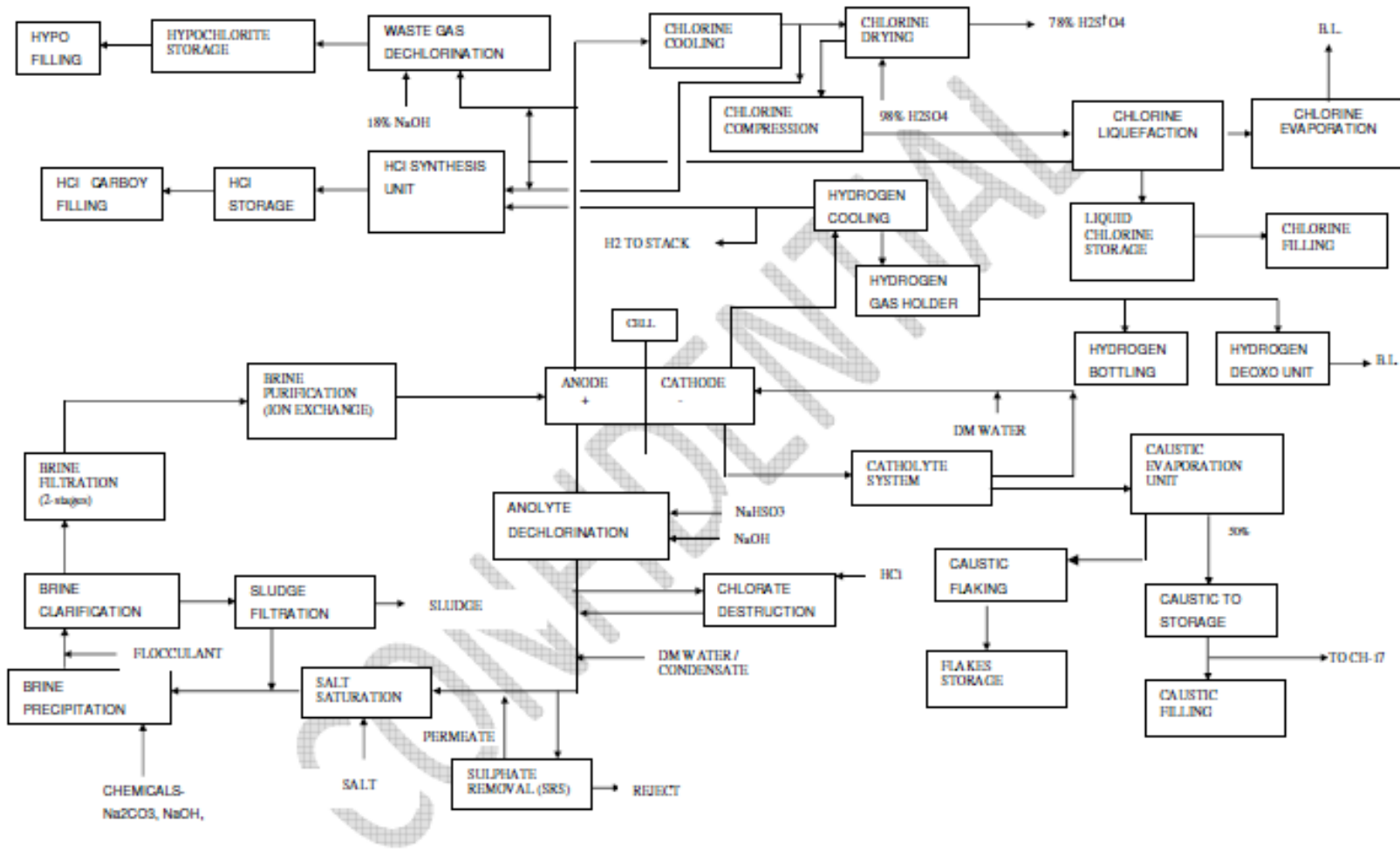
18.11.5 Plant air and Instrument Air System

Comprising of Unit 79

Plant air available from B/L is stored in Plant air receiver (79D001). From receiver plant, air is supplied to the internal consumers.

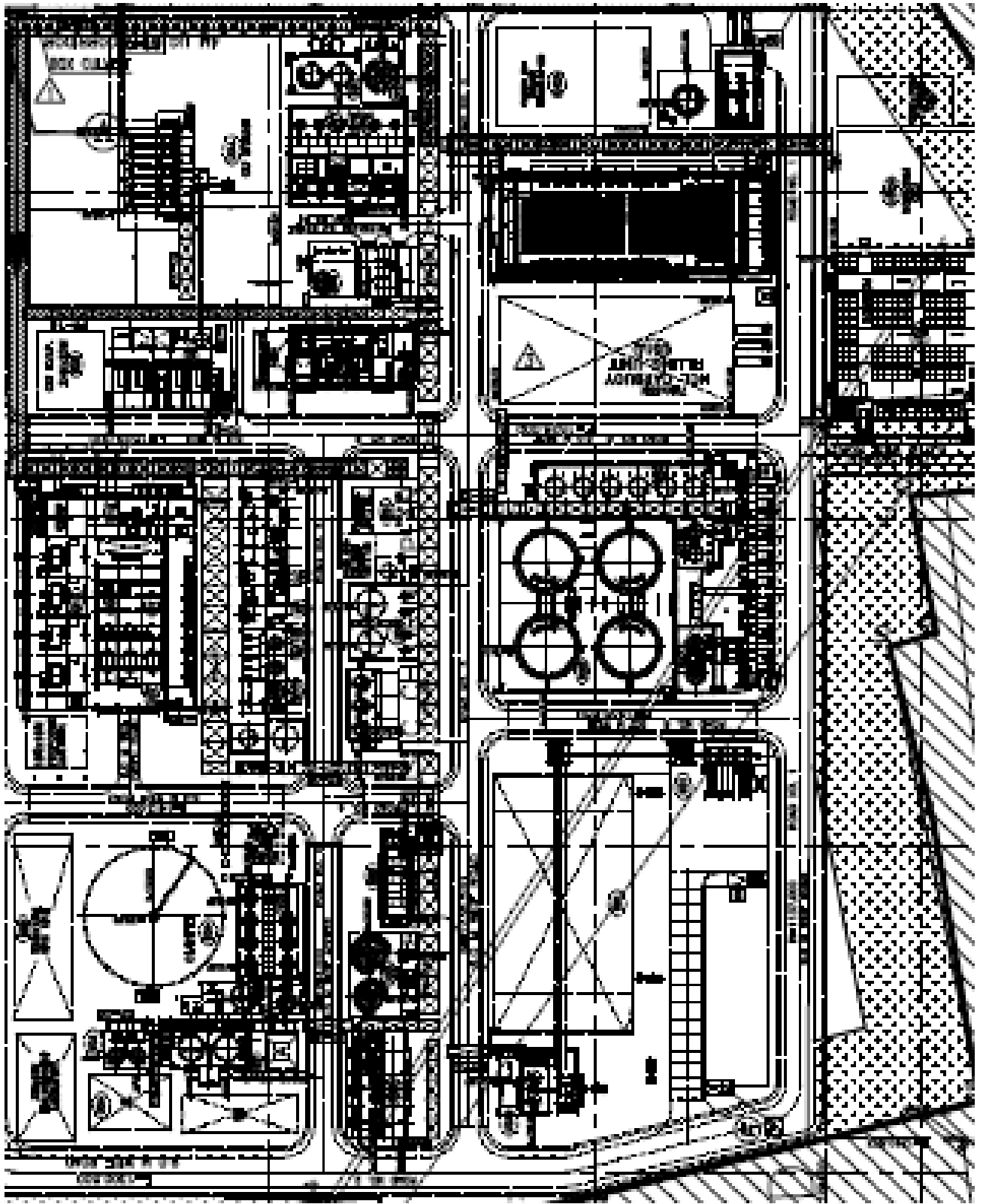
Instrument air available from B/L is stored in instrument air receiver (79D002). From receiver instrument, air is supplied to the internal consumers.

GACL-NALCO ALKALIES AND CHEMICALS PVT. LTD



PROCESS BLOCK FLOW DIAGRAM

LAYOUT – CAUSTIC SODA PLANT



19. Annexure 2: Indicative list of activities and estimated manpower requirement

The details provided herein are indicative only based on the operation of one of the caustic soda plant of similar size. The estimated manpower requirement is also indicative. The actual O&M activities may differ in GNAL plant based on the configuration, degree of automation etc.

The bidders need to make their independent assessment of the activities required to be performed as well as manpower and machineries required to be deployed.

- 19.1. Scope of work of Salt handling, salt saturation, Primary Brine treatment including chemical preparation, treatment, clarifier operation.
- 19.2. Scope of work of Secondary Brine, Caustic DCS control room operation, Cell house operation and cell workshop, process building, Chlorine liquefaction Chlorine Storage, Chlorine evaporation, HCL operation, Nitrogen Generation unit, refrigeration for chlorine liquefaction.
- 19.3. Scope of work of Caustic, HCL, sulphuric acid storages, Chlorine bottling & dispatch, Hydrogen handling, and compression, CEU & CCU, Operation, Product dispatches, Caustic nagging storage, and dispatches,
- 19.4. Estimates for Manpower (Operations)
- 19.5. Maintenance Contract for Mechanical (Maintenance of Rotary and Static Equipment), electrical equipment, and Instruments in the Caustic Plant with Free Issue Materials at GNAL
- 19.6. Estimates Manpower Maintenance

19.1. Scope of work for Salt handling, Saturation, Primary brine treatment, chemical preparation, clarifier operation section

A. Salt handling, Saturation

- i. Receipt of salt trucks at the salt handling unit.
- ii. Collection of the salt sample from every truck.
- iii. Sending Salt samples to Laboratory.
- iv. Date entry of the result from Laboratory
- v. Unloading of passed trucks on tippler, belt conveyor, bucket elevator from Local control panel/ desk/ room.
- vi. Reject and send back failed trucks to the security department for outward passage.
- vii. Making the heaps of salt in the salt storage area for storing the salt with help of payloaders (2 nos.) and JCB for round clock availability. For tractor-trolley as and when required.
- viii. Round the clock charging of salt in salt saturator by conveyor as well as payloaders (3) on a continuous basis including the arrangement of payloader for salt charging when salt trucks not available for charging of salt directly in the system.
- ix. Arrangement of JCB for digging of hard salt heaps whenever it is required.

- x. Removal mud lumps and other items like wood, plastic from salt at salt unloading hopper area and shifting to a disposal point.
- xi. Operation of salt unloading and charging equipment (truck tippers, conveyor belts, bucket elevators, hopper valves, dewatering pumps from tippler pit, bucket elevator pit and saturator pit, stacking belt/equipment)
- xii. Coordination and clearance of equipment/ electrical/ instruments for preventive/ break down maintenance.
- xiii. Communication with the control room
- xiv. Day to day housekeeping of salt handling unit in and around including plant drains.
- xv. Collection and recovery of Salt spillage from Salt storage and saturator charging area to the system.
- xvi. Maintaining logbook and process data, data entry.
- xvii. Maintenance arrangement for payloader and JCB.
- xviii. Arrangement of diesel for payloader and JCB.
- xix. Maintaining the level of salt in saturator and maintaining salt concentration in brine as per the plant requirement. (minimum concentration __ GPL in Sodium chloride brine).
- xx. Emptying and clearing of saturator pits. Draining and cleaning of saturator for preventive maintenance. Cleaning of saturators launders strainers periodically.
- xxi. Operation of saturator brine pumps. Cleaning of lines from saturator to Precipitation and chemical tanks periodically.
- xxii. Monthly Safety interlock checking periodically in salt unloading, conveying and charging system.
- xxiii. Preparation and levelling of the proper heap of salt for physical verification of salt stock during the audit.
- xxiv. Manual unloading of salt from salt trucks whenever salt unloading equipment is under shutdown/breakdown condition.
- xxv. Maintaining safe operating and maintenance conditions of salt handling and saturation section.
- xxvi. Indicative Manpower requirement for Salt handling section

S.No	Description	Quantity	Total Manpower
1	Panel operator for tippler, Belt conveyor and bucket conveyor operation (if failure of tippler) and saturator brine pump operator	1 no skilled per shift	3 +1(reliever)
2	Chemist for laboratory (salt analysis/ Brine analysis)	1 no skilled per shift	3 +1(reliever)
3	Drivers for 3 payloaders (stand by payloader can be operated by panel operator)	2 no skilled per shift + 1 no. skilled in G shift	8 including 1 in G shift and 1 reliever

4	JCB driver (Daily G shift and on need basis)	1 no. skilled in G shift	1
5	Tractor (daily G shift)	1	1
6	Unskilled laborers for salt handling section	4+3 nos. unskilled Per shift	27
Total			45

xxvii. Transportation vehicles for salt handling system

Sr. No	Vehicle	Quantity
1	Pay loaders (5 Mt capacity)	3 nos.
2	JCB	1 no.
3	Tractor (Daily G shift and need basis)	2 no.

The availability of the above-mentioned vehicles should be round the clock, except need based vehicles.

B. Scope of handling of Primary Brine treatment including chemical preparation, treatment, clarifier, Polishing filter RVDF operation

- i. Chemical bags shifting from warehouse to local charging station by forklift, charging and preparation of a solution of chemicals like soda ash, barium carbonate, flocal for dosing through pumps in precipitation tanks for removal of impurities like calcium, magnesium and sulfate from brine and maintaining process parameters.
- ii. Operation of precipitating tanks, ensure flow is normal and with proper agitation, dosing of chemicals as per standard process parameters.
- iii. Operation of agitators in precipitation tanks, Operation of clarifier, ensure the normal running of rack arm, maintaining the DM water seal in the clarifier, operation all primary brine section pumps, anthracite filters, polish filters, etc. Cleaning of mixing tank at clarifier periodically.
- iv. Operation of RVDF for removal of impurities as sludge from clarifier, Operation of Vacuum pump, filtrate pumps for RVDF and disposal of sludge to the defined area through tractor trolleys.
- v. Regular removal of sludge through trolleys to outside agencies/ GACL sludge pits.

- vi. Checking of various parameters like brine concentration (GPL, mg and ca in brine, excess OH and carbonate in brine, temp. of brine, the turbidity of brine, at from saturator outlet to clarifier outlet. Monitoring and controlling the parameters making it records and reporting. Any deviation in parameters is to be recorded including corrective actions for controlling the same. Data entry of all process parameters, chemical consumptions in section, reconciling of stocks.
- vii. Caustic evaporation vapour condensate and waste alkaline brine 100% recovery.
- viii. Removal of sludge from the sludge pit coming out from the clarifier and from the washing of RVDF.
- ix. Operation, isolation and backwashing of Anthracite filter for removal of suspended particles from brine.
- x. Removal /charging of anthracite from anthracite filter during maintenance time.
- xi. Operation, isolation and backwashing, precoat filter and maintenance.
- xii. Shifting the required alfa cellulose from the chemical warehouse by forklift, Preparation of alfa cellulose in preparation tank for precoating of filters and shifting of precoat sludge to the defined area (sludge pit to the outside agency through tractor trolleys).
- xiii. Housekeeping in the primary brine area and equipment.
- xiv. Obtaining the process clearance of equipment for maintenance in the primary brine section.
- xv. Follow the Safety permit and work permit.

C. Manpower estimates

Sr. No	Description	Quantity	Total Manpower
1	Operation of primary brine pumps, equipment's, chemical preparation filters, RVDF and maintain the brine parameters	1 No. Skilled manpower per shift	3+1
2	Chemist for lab	1 No. Skilled Manpower per shift	3 +1
3	Chemical Preparation with bags shifting and charging.	2No. unskilled manpower per shift in A & B shift	4 +2
4	RVDF & Polishing filter operation for sludge removing	2 unskilled manpower per shift	6 +2
5	Tractor trolley driver	2	2
Total			18 +4

D. Transportation vehicle for salt handling system

Sr. No	Vehicle	Quantity
1	Hydraulic trolley/ Fork lift operation for chemical shifting	2 nos.
2	Tractor trolley round the clock for RVDF.	1 nos.

The availability of the above-mentioned vehicles should be round the clock, except need base vehicles.

19.2. Scope of work of Secondary Brine, Caustic DCS control room operation, Cell house operation and cell workshop, process building, Chlorine liquefaction_Chlorine Storage, Chlorine evaporation, HCL operation, Nitrogen Generation unit, refrigeration for chlorine liquefaction.

A. Scope of handling of Secondary Brine, Process Building operation

- i. Operation and monitoring of the Ion-exchange column including sending the brine samples for analysis from Inlet and Outlet at regular intervals (till the plant is stabilized and Ca/Mg analyzers operation established) and after the regeneration.
- ii. Regeneration of ion exchange column.
- iii. Resin top-up/charging/ discharging in the ion-exchange column.
- iv. Resin discharging from the ion exchange column during maintenance work.
- v. Checking and replacement of the ion-exchange nozzle periodically.
- vi. Operation of pure brine pump for transferring of brine to cell house, brine heat exchangers.
- vii. Operation of vacuum tanks and pumps for the treatment of lean brine.
- viii. Preparation of Sodium bisulfite solution.
- ix. Dosing of Sodium bi-sulfite solution in lean brine for removal of free chlorine.
- x. Operation of chlorate destruction unit.
- xi. Operation of Chlorine recuperator, chlorine cooler, chlorine chiller for heating of brine and cooling of chlorine coming out from cell house.
- xii. Operation of wet chlorine filter.
- xiii. Replacement of candles in wet chlorine filter.
- xiv. Operation of drying tower for drying of chlorine coming out from cell house.
- xv. Checking of concentration of 78 % H₂SO₄ periodically.
- xvi. Transfer the 78 % H₂SO₄ from the day tank to the storage tank.
- xvii. Receipt of 98 % H₂SO₄ from the storage tank today tank for dosing in drying tower.
- xviii. Operation of the chiller for 78 % H₂SO₄ and 98 % H₂SO₄ for drying tower.
- xix. Replacement of packings (pall rings) in the drying towers.
- xx. Removal of packings (pall rings) from the drying tower during maintenance.
- xxi. Operation of day chlorine filter after drying tower.

- xxii.Replacement of candles for dry chlorine filter.
- xxiii.Operation of hydrogen filter for filtration of hydrogen coming out from cell house.
- xxiv.Replacement of candles in hydrogen filter.
- xxv.Operation of hydrogen cooler and chiller used for cooling of hydrogen coming out from cell house.
- xxvi.Operation of DM water tank and pumps for transferring the DM water to various sections of caustic soda plant. Maintain the DM water requirement.
- xxvii.Operation of waste alkaline tanks and pumps for transferring the alkaline waste coming out from ion exchange regeneration step to saturator.
- xxviii.Operation of intermediate pumps for transferring the acid waste coming out from the ion-exchange regeneration step to ETP.
- xxix.Continuous communication with the shift In charge and control room for smooth operation.
- xxx.Housekeeping in the secondary brine area and equipment.
- xxxi.Give the process clearance of equipment for maintenance.
- xxxii.Safety permit and work permit clearance.
- xxxiii.Maintaining data entry and logbooks for plant operation

B. Scope of handling of HCl, Hypo Plant, ETP.

- i.HCl/Hypo Plant Day to day shift activities in HCl/Hypo area for stoppage/start-up and schedule changeover of equipment.
- ii.Monitoring the process parameters and log in the logbook.
- iii.Maintaining process operational parameters as per specification and deviation inform to shift f/m.
- iv.Isolation of equipment's for maintenance work
- v.Safety and Housekeeping of the concerned area.

a) HCL plant Operation

- i.Operate HCL plant operation as per the operation and maintenance of the HCL synthesis unit.
- ii.Operate valve of cooling water for the HCl furnace
- iii.Operate Cl₂ and H₂ isolation valve for HCl Furnace, Start-up activities of air blower for the furnace.
- iv.Nitrogen purging activities before start-up of furnace
- v.DM water operation for furnace
- vi.Steam generation from HXCL plant
- vii.HCl furnace operation data entry in the logbook.
- viii.Safety precaution during HCl Unit start-up, sampling and transferring

b) Hypo plant Operation

- i.Operation and maintaining chilled water circulation for 18% NaOH Preparation and maintaining product temperature.
- ii.Maintain the level of 18 % NaOH tank.
- iii.Check the concentration of the hypo product and suction tank, verify with redox meter.
- iv.Operate chlorine inlet valves connected to the main suction header of hypo.

- v. Record the redox meter in line and ensure that it has to be calibrated.
- vi. Transfer the hypo product from the day tank to liquid storage tank for dispatch as per level.
- vii. Stoppage and shutdown operation of hypo plant as per instruction from GNAL In charge.
- viii. Monitor the parameters and record data in logbooks.
- ix. Taking a sample and submit a hypo to the laboratory.

c) ETP operation

- i. Effluent shall be received from the various section and discharge to a common effluent system after physiochemical treatment. Includes complete operation.

C. Manpower detailed for secondary brine, HCL, Hypo ETP section

S.No	Description	Quantity	Total Manpower
1	Skilled operator for activities & The operation for secondary brine, heat exchanger, pure brine pump heat exchanger, electrolyzers and maintain the electrolyzers parameter, HCL Hypo	2 No. Skilled manpower per shift + 1 skilled in G shift	7 +1
2	Unskilled Workers / Helpers	2nos. unskilled per shift	6
Total			14

D. Scope of handling of cell house and cell workshop Cell house:

- i. Operation of catholyte pumps and heat exchanger for heating or cooling of caustic soda supplying to electrolyzers.
- ii. Operation of anolyte tank and pumps, cell drain tanks and pumps.
- iii. Safe shutdown and start-up of electrolyzers.
- iv. Filling, heating, energizing and start-up of the single electrolyzer.
- v. Isolation, the killing of free chlorine, cooling, and draining of a single electrolyzer for maintenance.
- vi. checking of various parameters at regular intervals of time like brine GPL at inlet and outlet of electrolyzers, inlet caustic concentration, outlet caustic concentration, Differential pressure of chlorine and hydrogen of every electrolyzer, temp. of anolyte from electrolyzer, temp. of the catholyte of electrolyzers. Data entry of all process parameters.
- vii. Checking of chlorine purity at electrolyzer outlet by orsat gas apparatus till stabilization and established the hydrogen in chlorine analyzer operation.

- viii. Checking of rest gas in chlorine outlet at electrolyzer.
- ix. Monitoring of voltages of every element in every electrolyzer once per day.
- x. Cleaning strainer of caustic and brine going to electrolyzers periodically.
- xi. Obtaining the process clearance of equipment for maintenance in the cell house
- xii. Operation of pump used for transferring the 32 % caustic soda from cell house to Caustic evaporation section.
- xiii. Housekeeping in the cell house.
- xiv. Follow the Safety permit and work permit.
- xv. Operation of DCS to run the plant.
- xvi. Operation of the rectifier, cooling water pit and pump.
- xvii. Chlorate destruction unit operation

E. Cell workshop:

- i. Removal of cell elements from cell rack.
- ii. Shifting of elements from cell rack to workshop.
- iii. Operation of crane for lifting of the element from electrolyzer and shifting for maintenance.
- iv. Preparation of cell parts.
- v. Issue/shifting of cell hardware from store/plant.
- vi. Dismantling of elements.
- vii. Washing & cleaning of anode/cathode pan, membranes.
- viii. New membranes to be kept in a membrane bath.
- ix. Preparation of elements anode/cathode (total cell assembling job including anode/cathode membrane flanges, gaskets, bolting and other hardware) including Gore tax fixing.
- x. Testing of assembled elements.
- xi. Pressure testing if a failure, it is to be dismantled and prepare a new one.
- xii. In case of leakage after installation of elements, it is to be dismantled & to be prepared again.
- xiii. Shifting of elements to cell rack, installation & refixing of elements.
- xiv. Material reconciliation after completion of job.
- xv. Erection of elements on the cell rack.
- xvi. Hose connection (inlet/outlet).
- xvii. Taking bubble test I and bubble test II for checking membrane leakage.
- xviii. Disposal of used cell hardware, including membranes. □ Housekeeping of work place.

F. Manpower detailed for cell house and cell workshop section

Sr. No	Description	Quantity	Total Manpower
1	Operation of catholyte/ anolyte pumps, heat exchanger, gas analysis etc	2 skilled per shift	7

2	Preparation of element, inlet and outlet connection and disconnection of element.	2 No. skilled manpower in G shift	2
3	Shifting of element from electrolyzer to cell workshop and shifting of ready element from cell workshop to electrolyzer, washing of half shells, housekeeping of cell house and cell workshop, shifting of issued material from store to cell workshop etc.	4 unskilled manpower	4
4	Fitter & welder G shift (for repair anode/cathode cell assemblies and fitting)	1 no. skilled in G Shift	1
Total			14

G. Transportation vehicle for cell workshop

Sr No	Vehicle	Quantity
1	Hydraulic trolley for shifting of elements from one place to another place.	4 no.

Availability of above-mentioned vehicles should be round the clock, except need base vehicles.

H. Scope of work of Caustic DCS control room operation

- i. To ensure production targets are met.
- ii. Overall responsibility for quality in Caustic Soda Plant.
- iii. Responsible to ensure all parameters and authorize to change the given limit of parameters as and when required to run the plant stable and safe.
- iv. Ensuring availability of materials for production.
- v. Overall responsibility of materials for production.
- vi. Approval of inspection results for raw materials and finished products.
- vii. Co-ordination with Maintenance, Purchase, Stores and Marketing.
- viii. Co-ordination with Maintenance department for giving clearance for preventive maintenance or breakdown maintenance of equipment.
- ix. Overall supervision of operation of sections.
- x. Section In charge shall perform the function of Dept. In charge in absence of Dept. Incharge.
- xi. Responsibility for safety in the Plant.
- xii. Approval of Inspection results of raw material and finished products.

- xiii. To assist Functional In-charge in 'GENERAL SHIFT'.
- xiv. Co-ordination for training and safety audit.
- xv. To co-ordinate modification and alterations scheme.
- xvi. Ensuring that plant operates smoothly in the shifts to enable achievement of production targets, process parameters and quality norms.
- xvii. Ensuring safety in shifts.
- xviii. Identifying abnormalities in process, equipment and take or initiate corrective actions.
- xix. Preparing abnormality report for maintenance.
- xx. Initiating corrective actions for observed abnormalities, and co-ordination with Maintenance department.
- xxi. Preparation of production, consumption and profitability report on daily basis.
- xxii. Observing process parameters at different points during manufacture and logging them as per requirement.
- xxiii. Taking corrective actions or instructing the operator concerned to take necessary action and also to ensure that required process parameters are maintained.
- xxiv. Safe stoppage of the plant, in case of any eventuality requiring plant stoppage.

I. Manpower detailed for Caustic soda DCS control room

Sr. No	Description	Quantity	Total Manpower
1	Shift In charge	1 No. Skilled manpower per shift	3 +1
2	DCS control room include operation of caustic soda plant.	2 No. Skilled Manpower per shift	3+1
Total			8

J. Scope of handling of Chlorine compression, Chlorine liquification, Liquid Chlorine Storage & Chlorine evaporation operation

- i. Day to day shift activities in Chlorine liquefaction system and Liquid Chlorine Bullet area fieldwork.
- ii. Leak test of chlorine and Refrigerant system.
- iii. To maintain process operational parameters records.
- iv. Changeover of bullet as per plant requirement and statutory hydro testing of bullet. Isolation of equipment for maintenance and taking in operational trial after maintenance safety and Housekeeping of concerned area.

a) Cl₂ Compression:

- i. Operation of Cl₂ compression in local control panel.
- ii. Opening / Closing of Cl₂ inlet and outlet valves.
- iii. Opening / Closing of Cooling water inlet and outlet valves for inter stage coolers and outlet cooler.
- iv. Operation of cooling water pumps for Cl₂ compressor.
- v. Monitor cooling water tank level.
- vi. Check cooling water sample for free Cl₂, send samples to laboratory. Data entry of process parameters, compressor parameters, laboratory reports in the log book.
- vii. Safe stoppage and start-up of Cl₂ compressor as per procedure.
- viii. Communicate / Coordinate with DCS Operator.
- ix. Housekeeping of Cl₂ compressor area.
- x. Follow safety and work permit

b) Liquid Cl₂ pumping:

- i. Day to day shift activities in Liquid Chlorine pumping system and Liquid evaporation area
- ii. Leak test of chlorine in chlorine buffer vessel, liquid chlorine pump area. To maintain process operational parameters records
- iii. Monitoring of Chlorine buffer vessel, Operation of Liquid Cl₂ pump as per operation procedure.
- iv. Changeover of liquid chlorine pump
- v. Isolation of equipment for maintenance, statutory hydro testing and taking in operation after maintenancex. Communicate / Coordinate with DCS
- vi. Housekeeping of Cl₂ compressor area
- vii. Follow safety and work permit

c) Chlorine Evaporation System Low pressure & for GNFC/GACL:

- i. Check level of liquid Cl₂ in kettle type evaporator (both low pressure & high pressure for GNFC).
- ii. Maintain process parameter of chlorine evaporation system as required and record the same in the log book.
- iii. Monitoring and operation of EG brine system for chlorine evaporation (both low pressure & high pressure for GNFC)
- iv. Leak test of chlorine in chlorine evaporation system (both low pressure & high pressure for GNFC)
- v. Periodically drain liquid Cl₂ from evaporator (both low pressure & high pressure for GNFC) to NCl₃ destruction pot.
- vi. Operate NCl₃ destruction pot as per procedure.
- vii. Take sample and send to laboratory for NCl₃ analysis and record the laboratory result. Operation of chlorine evaporation system as per procedure.
- viii. Communicate / Coordinate with DCS. Housekeeping of Cl₂ compressor area. Follow safety and work permit as per GNAL requirement.

- ix. Chlorine Evaporation unit operation including Liquid Cl₂ Pump, EG brine pump and chilled water pumps, stoppage and changeover. Monitoring of EG brine PH and Redox in every 2 hrs. Sampling to QCD. Evaporator pressure & Level, liquid Chlorine line rupture disk pressure and its related control valves monitoring in every 2 hrs. Preparation & replacement of EG brine as and when required. Leak test of chlorine lines shift wise. Maintain Chlorine sensors and on Line BA set healthiness all the time.

d) Chlorine Refrigeration System Operation

- i. Operation of compressor and local at LCP.
- ii. Operate suction valve, discharge valve and Refrigerant economizer to suction valve.
- iii. Operation Cooling water valve for Refrigerant condenser and oil cooler for chlorine liquefier.
- iv. Maintain Oil and Refrigerant level.
- v. Operate Oil pump and check Oil pressure and diff pressure at Oil and gas.
- vi. Stoppage start-up of liquefier, unload the Refrigerant compressor from control panel. Records data of chlorine liquefaction operation parameter.

K. Manpower detailed for Chlorine compression, Liquid chlorine storage and Chlorine liquefaction, Evaporation section

S. No	Description	Quantity	Total Manpower
1	Shift operator for Chlorine liquefaction, compression & storage	1 no. skilled per shift	3 +1
Total			4

19.3.Scope of work of Caustic, HCL, sulphuric acid storages, Chlorine bottling & dispatch, Hydrogen handling and compression, CEU & CCU, Operation, Product dispatches, Caustic nagging storage and dispatches

A. Scope of work for handling of Chlorine bottling section: -

- a) EMPTY TONER RECEIPT (ECR)
 - i. Unloading of toners, note down Truck No. with no. of toners received as empty.
 - ii. Write down individual toner no. with HT due date & shortage of toner accessories like cover hood, Valve cap and stud, Nut.

- iii. Physical inspection of unloaded toner for any dent, colour other than yellow and valve, plug, stencilled condition and marking of HT due toners, Tile test to confirm presence of foreign material inside.
- iv. All detail writes down in ECR card and Hand over to GNAL In charge to verify and authorize actual status in ECR SAP module.
- v. Shifting and stacking of empty/new toners as per plant requirement.
- vi. Stock verification of cover hood, valve cap & stud nut on daily basis.
- vii. Correction of stencil on toner as per requirement. Report to GNAL In charge for plant status and abnormalities shift wise.

b) TONNER DEGASSING & FITNESS

- i. Cl₂ confirmation test through Ammonia and degassing of each & every toners.
- ii. Toners, which are, failed Ammonia test, needs pressurization with dry air to confirm for existence of Cl₂. If confirm ammonia test ok then proceed for next step for valve & spindle checking, cleaning & replacement if any defects like hard operation of spindle, improper groove of spindle, cut or damage on valve body.
- iii. Ensure HT due toners shifted to HT area with mark over toner, fitness of toners by checking valve/spindle operation which should be verified OK. Verify present tare weight by hanging balance and compare with last HT tare weight. If weight difference is +/- 2 kgs then provide fitness certificate (Yellow Tag duly stamped & Signed) on toners and send for filling at filling station. If tare weight is more/less than +/- 2.0 kgs then inspect inside by opening plug through 12 V DC bulb for corrosion, dust or foreign material. If there is no any dusting or foreign material then correct tare weight after fixing plug properly. If found dust or foreign material inside toner then send for Hydro Testing.
- iv. Above whole process from Cl₂ confirmation to fitness data mention in Hypo/Fitness Log-book.
- v. Enter whole data to SAP of toner fitness module and authorise.
- vi. Hydro tested and verified toners shifting, checking and fitness tagging to make fit for filling.
- vii. Arise of leakages or defects in any filled toners, needs rectification at Hypo/Fitness area by degassing to fitness process.
- viii. Preparation and maintenance of Hypo header and its accessories replacement.

c) TONNER FILLING PROCESS

- i. Use applicable PPEs like Leather hand gloves, safety shoe & Cartridge mask for safe filling.
- ii. Confirm fitness certificate is placed on toner, Toner stencil shall be verified and readable.
- iii. Check hanging balance and platform balance.
- iv. Verify tare weight on toner is matching with filling balance indicator. If difference is +/- 2 kgs then check both toner valves are in close position.
- v. Write balance no., Tonner no. & Tare weight in filling card.

- vi. Connect filling tube with lead washer & clamp to toner valve.
- vii. Open toner & filling tube valve.
- viii. Close Hypo valve of filling header and open slightly main filling valve to start Liquid Chlorine filling into the toner.
- ix. Check leak test of all joints with ammonia torch.
- x. If no leakage then proceeds for further filling. If found any leakage then stop filling immediately by filling header valve and open Hypo valve to evacuate liquid chlorine from filling tube & header to hypo. Attend leak point and proceed as above.
- xi. Check temperature sensor indicator just after start up filling.
- xii. Fill Liquid Chlorine 900 kgs+/- 5.0 kgs (tare weight +Net weight= Gross weight), close main filling valve, toner valve and filling tube valve respectively and open Hypo valve. Loose valve clamp minutely to ensure no passing of toner valve.
- xiii. Check gross weight of toner with hanging balance and maintain net weight +/- 5.0 kgs and if any deviation then make it correct as per norms +/-5.0 kgs. Check leak test after filling of each & every toner.
- xiv. Note down gross weight of toner in filling card as well as in yellow tag with all detail. All filled toner data is entered in SAP filling module.
- xv. Isolation and evacuation of filling header for maintenance work like header valve & filling tube replacement work.

d) DISPATCH SECTION

- i. Proper stacking of filled toners.
- ii. Chlorine leak test and weight verification of each filled toner.
- iii. Preparation of filled toner lot in SAP and QCD approval of lot. If any deviation in lot then send back to filling or Hypo for corrective action.
- iv. As per Marketing DO requirement, prepare filled toners ready with proper fixing of valve cap and cover hood on toners. Note down these toner no. in dispatch card.
- v. If physical condition of truck is ok then the same toners are loaded on truck mentioned in DO and dispatch card H/O to GACL In charge for toner entry in respective DO.
- vi. Reporting abnormalities of filled toner and cranes to GACL In charge on shift wise.

e) Scope of work for Breakdown Maintenance of all components of EOT Cranes, Hoist, Chlorine sensor, weight scale equipment, lighting etc.

Mechanical scope of work:

- i. General checking of the Crane/Hoist.
- ii. Topping oil in the gear boxes.
- iii. Checking lubrication of crane.
- iv. Lubrication of wire ropes.
- v. Replacement of LT/CT wheels including bearings, wheel shafts, couplings, pedestals, gears, etc.

- vi. Drive mechanisms - LT, CT and hoist motions, replacement of gear boxes, bearings, oil seals, gaskets, gears, input/output shafts, couplings, coupling bolts, drive shafts, pulleys, etc.
- vii. Wire Ropes - Replacement of worn out/broken/crushed/damaged wire ropes, arranging for wire rope clamps.
- viii. Hook block of hoists - Replacement of damaged / worn out hooks. Replacement of damaged / defective pulleys and any other damaged components of the hook blocks.
- ix. Checking and replacement of crane end stoppers on LT and CT motion.
- x. Restoration of trolleys at the time of derailment.
- xi. Checking and repairing bogie system on end carriages and repairing damages to structures.
- xii. Checking and replacement of brake units / brake liners, replacement of springs, adjustment of studs etc.

Electrical scope of work

- i. Attending breakdown of electrical nature.
- ii. Replacement / minor repair of motors.
- iii. Replacement of fuses / fuse holders in electrical panels.
- iv. Replacement of contactors or contact points, if necessary.
- v. Replacement of cables.
- vi. Repair / replacement of incoming mains switches on panel.
- vii. Replacement / checking of brake units.
- viii. Maintenance of junction boxes of CT, LT, MH, AH, Pendent, etc.
- ix. Repair / Replacement of cable trolleys.
- x. Repairs / Replacement of floor operation push button pendent including push buttons
- xi. Repair / Replacement of master control switches.
- xii. Topping / Replacement of oils in brake units.
- xiii. Tightening loose connection on terminal boards.
- xiv. Checking / Repair / Replacement of CT, LT rotary and counter weight limit switches.

Instrumentation scope of work:

- i. Checking of Radio Remote Control System.
- ii. Minor repair / Replacement of remote-control transmitter and receiver
- iii. Replacement push buttons of weight electronic on hoist/chains in case of faults.
- iv. Replacement / Adjustment / Tuning of variable frequency drives (VVVF).

Cleaning scope of work of cranes/hoist:

- i. All cranes to be cleaned 3 times in a year at regular intervals to remove any kind of waste materials / dust / oils / grease, unused cables, etc.
- ii. Preventive maintenance of all EOT cranes mentioned in the document.
- iii. M&S/Cranes/Terms/Outsource at periodicity indicated by GNAL.

B. Manpower detailed for chlorine bottling section (basis for 500(250 Filled+250 Empty) tonners handling)

Sr. No	Description	Quantity	Total Manpower
1	Shift supervisor for data entry	1 no. skilled per shift	3
2	ECR, Hypo / sniffing of tonners activities & Operation	4 No. unskilled manpower per shift	12
3	Chlorine tonner filling operation	15 no. Unskilled Manpower per shift	30
4	Tonners despatch	2 No. unskilled manpower per shift	6
5	Tonners hydro testing	2 nos. unskilled in G shift	2
Total			53

C. Scope of work for Hydrogen handling and compression section

- i. H2 Holder parameters like, level & pressure monitoring, water flow adjustment in H2 seal as well as H2 holder
- ii. H2 Blower operation for HCl & CCU as per availability of H2.
- iii. H2 Blower pressure /temp monitoring and log of process data every 2 hrs.
- iv. H2 Compressor monitoring and leak test of H2 ShiftWise.
- v. Maintaining compression ratio by loading /unloading of compressor.
- vi. H2 suction /discharge pressure, oil pressure & DP across filter and cooler. Adjustment of cooling water in condenser and its temp/pressure profile monitoring and logging in log book at every two hrs.
- vii. Use of PPEs for safety and Housekeeping of concerned area.

D. Hydrogen battery filling operation

- i. Check physical condition of truck as per checklist for mounted Hydrogen bank, cascade, manifold and its isolation valves healthiness and if ok then proceed further. If observe any improper fittings of cylinders and its accessories, support

- of bank for any loose observation then reject and send back to Marketing with reason of rejection on DO and inform to Shift Incharge.
- ii. Battery received from party is to be checked first for Cylinder Birth certificates (Manufacturing certificates), CCE certificates, Hydro test certificates, as a statutory compliance.
 - iii. Check battery cylinders filling capacity 150 kg/cm² or 200 kg/cm², Marketing D.O. is to be accepted as per design filling capacity only.
 - iv. Check cylinders certificates with GNAL master file and If HT is not due than QCD (Quality Control Dept.) slip is to be filled for gas content analysis.
 - v. Check battery must have positive pressure, if pressure is zero then inform Shift Incharge and marketing department. Zero pressure battery may contain air and other gasses so it is not to be filled without clearance from superior and QCD.
 - vi. After QCD Ok, connect battery on filling header.
 - vii. Wheel chokes are to be put at Battery (Truck) tyres' both sides to prevent it to move forward and reverse during filling and leak testing jobs.
 - viii. As per CCE rule double earthing for each battery is to be given during filling, one earthing for Cascade (H₂ cylinder battery) and second for Truck body. Verification must be done by green LED (Healthiness of Earthing) earthing meter. If find any LED red (Unhealthiness of Earthing) then fix earthing crocodile pin properly to make it green LED. Still observe red LED then inform Electrical to check earthing meter and its probe. Do not start filling with red LED.
 - ix. Open battery filling valves and all cylinder's individual isolation valves so now it is line up with main filling header but do not open the header filling valves before flushing of header. □ Vent valve of header is to be kept open, start water in seal pot.
 - x. Check oil level of compressor, H₂ pressure at receiver and Interlock healthy indication at H₂ cabin panel (No alarm bulb glow means all interlock are healthy) Ask for clearance to Main control room for compressor start up.
 - xi. Start compressor, flush header with hydrogen by closing vent valve of header and take 50kg/cm² pressure on header than open it, do this exercise minimum two times and finally close the vent valve and open the filling valve.
 - xii. Take leak testing on every 25, 50, 75, 100, 125, 150 kg/cm² pressure, in case of 200 kg/cm² battery further pressure testing is to be continued at 175 and 200 kg/cm² with dense soap solution, during this intermediate leak test if any part of cascade or fitting, connecting tubes, pig tails, valve-cylinder bushing and valve gland leakage observe than battery filling is to be stopped immediately, Inform Main control room, Shift In-charge, Marketing Dept. and bottling foreman if leakage is in increasing trend than inform to CCR, Fire Dept. and security.
 - xiii. Leakage battery is to be transferred to another battery at slow rate (Rate not more than 220 nm³/hr. because all headers and filling tubes designed for this optimum flow) and battery which is leakage is to be kept wet with constant water spray with the help of Fire Dept. , The header which in operation for battery transfer is not to be used for any other battery filling with compressor .Header temperature is to be measured periodically with temperature gun. After complete transfer empty battery with Zero pressure is to be sent back to marketing department for repairing.
 - xiv. Take readings of all parameters for each running compressor during battery filling also check that condensate drain cycle must operate at every 20 to 22 minutes for its specified time (Time set by Instrument department as per actual

condensate quantity), Condensate pot is to be drained as per level in its two sight glasses, during draining its level should not go below bottom side middle portion of sight glass.

- xv. Ensure of operation of sprinkler system.

E. Manpower details for Hydrogen handling and compression section

Sr. No	Description	Quantity	Total Manpower
1	Shift Operator of hydrogen holder, blower, compression & filling batteries	1 no skilled per shift	3 +1
Total			4

F. Operation scope of work for CCU operation, Caustic warehouse and Caustic Soda lye tank farm section

- a) CCU Control panel scope of work
- i. Operation of DCS for running of plant
 - ii. Maintaining parameters as per requirement
 - iii. Monitoring of all process parameters on DCS on 24-hrs Basis
 - iv. Start-up & Stoppage of Plant through DCS for CEU, CCU and prilling plant
Emergency stoppage of plant.
 - v. Maintaining of log books including all important parameters.
 - vi. Preparation of daily production report and raw material consumption report & stock statement
 - vii. Preparation and submission of daily equipment abnormality report of all sections
 - viii. Communication with Main Control room for synchronizing the operations with overall production planning
 - ix. Communication with other Departments Such as Mechanical, Electrical, Instrumentation, Civil for informing abnormalities respectively
 - x. Clearance of equipment for attending abnormalities
 - xi. Activities related to issuing Safety permit, Work permit and process clearances for attending abnormalities as per instruction by GNAL In charge.
 - xii. Monitoring of shift activities and operators' activities in specific areas to GNAL In charge.
 - xiii. Maintaining & monitoring of all analysis of final product, raw material & all process streams as required.
 - xiv. Maintaining the housekeeping and 5S system in plant area.
 - xv. Co-ordination with marketing dept for dispatch of the finished product.
 - xvi. Ensure all safety norms for the operations & proper use of personal protective equipment (PPE) during operation by all workers.
 - xvii. Sugar solution preparation with required concentration and dosing.
 - xviii. Checking of all the interlocks through DCS.

- b) Caustic Evaporation operation scope of work
- i. Start up and stoppage of caustic evaporation unit
 - ii. Emergency stoppage of plant
 - iii. Regular round of plant to find out abnormality & leakages in plant
 - iv. Maintaining log book for all parameters
 - v. Cleaning of heat exchanger, evaporators & condenser on during shut down
 - vi. Give the process clearance of equipment for maintenance.
 - vii. Safety permit and work permit clearance
 - viii. Communication with control room and other engineering department
 - ix. Day to day housekeeping of plant area including plant drains
 - x. Caustic Concentration Operation scope of work
 - xi. Start up and stoppage of caustic evaporation unit
 - xii. Emergency stoppage of plant
 - xiii. Regular round of plant to find out abnormality & leakages in plant
 - xiv. Maintaining log book for all parameters
 - xv. Cleaning of heat exchanger, evaporators & condenser on during shut down
 - xvi. Give the process clearance of equipment for maintenance.
 - xvii. Safety permit and work permit clearance
 - xviii. Communication with control room and other engineering department
 - xix. Day to day housekeeping of plant area including plant drains
 - xx. Manual level monitoring of Heating salt tank
 - xxi. Charging of heating salt as and when basis
 - xxii. Removal of salt from salt tank
 - xxiii. bagging of Caustic soda flakes in 25 kg/50 kg packing
 - xxiv. Maintaining of empty bags in plant
 - xxv. Temperature checking of flakes during bagging
 - xxvi. Re bagging of CS flakes for Damaged bags
 - xxvii. Separation of off grade Flakes during start-up of Flaker
 - xxviii. Dissolving of off grade flakes on regular basis
 - xxix. Keeping record for storage of Flakes in area wise and also batch wise
 - xxx. Arrangement and proper handling of empty pallet
 - xxxi. Batch marking on empty bags before Filling of flakes
 - xxxii. Random checking of filled flakes bags for weight variation
 - xxxiii. Calibration of weight balances on daily basis.
- c) Liquid Dispatch for CSL
- i. Level monitoring of receiving Tank
 - ii. Changeover of receiving tank after full level
 - iii. Circulation of received tank and offer to quality department for approval
 - iv. Maintaining logbook and all dispatch record
 - v. Inspection of empty tanker
 - vi. Sealing of filled tanker and keeping record
 - vii. Provide sample to each tanker for all dispatches
 - viii. Give the process clearance of equipment for maintenance.
 - ix. Safety permit and work permit clearance
 - x. Communication with control room and other engineering department

xi. Day to day housekeeping of plant area including plant drains

d) Manpower detailed for CET& CCU operation, Warehouse & CS lye tank farms section

Sr. No	Description	Quantity	Total Manpower
1	CCU & CEU Plant field operator	1 no skilled per shift	3 +1
2	Liq Caustic tank farm section operator	1 no skilled per shift	2+1
3	Unskilled labour for CSF bags filling, Caustic lye tank farm section, warehouse	8 nos. Unskilled Per shift	24
Total			31

e) Transportation vehicle for loading warehouse

Sr. No	Vehicle	Quantity
1	2 MT capacity forklift	3 nos.

Availability of above-mentioned vehicles should be round the clock, except need base vehicles.

G. Scope of work for utility section

- i. Start-up/stoppage/changeover of rotating equipment like, compressors as per plant requirement and as per SOP.
- ii. Maintain air quality and pressure of unloading air.
- iii. Record Compressors standard parameters like Oil pressure & temp, pressure & temp of each stage, DP of dryer I/L & O/L air, condensate drain cycle, dew point O/L air, Cooling water pressure & temp in every 2 hrs.
- iv. Air leakage to be identified and to be rectified.
- v. Unloading Air dryer operation sequence monitoring, in which regeneration of one dryer by heating & cooling of regeneration dryer and another to get quality air of -60 degree C dew point.
- vi. Data entry of logbook in every 2 hrs of running compressor and dryer.
- vii. Replacement of dryer molecule sieve as and when required.
- viii. Start up / stoppage/changeover of N2 PSA units, Monitoring of on/off valves operation sequence, Air pressure & O2 content less than 0.2%. Logging of logbook in every 2 hrs.

- ix. Chilled Water pump and compressor start up/stoppage / changeover as per plant requirement and as per SOP.
- x. Maintain chilled water temperature as per process requirement. Logging of all chilled water process operation data in every 2 hrs.
- xi. Use of PPEs for safety and Housekeeping of concerned area.

H. Manpower detailed for Utility section

Sr. No	Description	Quantity	Total Manpower
1	Shift Operator of utility operation, Process air compression and nitrogen compression	1 no skilled per shift	3
Total			3

Sr No	Other Job to be carried out with semi-skilled and unskilled manpower
1	Salt Unloading and Charging
2	Toners filing , unloading and dispatch, Hydrogen filling
3	Chemical shifting, charging and empty bags returns to store
4	RVDF operation , sludge handling , pit cleaning
5	Flacks bagging, shifting, dispatch
6	Membrane Preparation

19.4. Estimated Manpower for CSP Operation

Sr. No.	Section	Skilled		Unskilled	Semi-skilled	Total
		Officers	Operators/ Drivers & others			
1	Functional Head	1	-	--	--	1
2	Department Head/ assistant	3 +3	-	--	--	6
3	Salt handling section	-	18	27	-	45
4	Primary Brine section		8	14	--	22
5	Secondary Brine, HCL, Hypo		8	6	--	14

6	Cell house and workshop section		10	4	--	14
7	Caustic DCS control room operation	8	-	--	--	8
8	Liquid Chlorine Storage & Chlorine Liquefaction operation		4	--	--	4
9	Chlorine bottling section		3	50	--	53
10	Hydrogen handling and compression section		2	--	--	2
11	CCU, CEU & Liquid Caustic despatch		7	24	--	31
12	Utility section		3	--	--	3
Total		15	88	100	-	203

Note: For scheduled shutdown the number of manpower/ tools and tackles to be worked out at the time of shutdown planning for which schedule of rate will be applied.

19.5.Maintenance Contract for Mechanical (Maintenance of Rotary and Static Equipment), electrical equipment, and Instruments in the Caustic Plant with Free Issue Materials at GNAL

a) General Mechanical Maintenance work

- i. FLANGE disconnection/ connection (Blinding/ de-blinding), Tightening of Flanged Joint, HOSE Connection/ disconnection
- ii. Correction of Gland Leakage/ replacement of equipment, valve.
- iii. Cleaning or Replacement of All types of Filters/strainer/Cooling tower screens.
- iv. Charging/Replacement of lubricants & Greasing.
- v. Pipe hydro testing.
- vi. Manual handling/ Lifting & shifting of all types of materials/ instruments/ equipment's at all heights/ work locations.
- vii. Maintenance of All Types of Heat Exchangers at Site and hydro test of All Types of Heat Exchangers at Site.
- viii. Preventive maintenance of Centrifugal, Reciprocating, Screw, Gear, Vane type pump & compressor.
- ix. Preventive maintenance of Fans/ Blowers.

- x. De-coupling, coupling and alignment checking of any Rotating equipment.
- xi. Replacement/Inspection of Bearing, Coupling, Seals.
- xii. Removal & fixing of Belts/Chain.
- xiii. Mechanical Seal repair at shop/replacement and oil seal replacement at the site.
- xiv. Overhauling/inspection/replacement of Gearbox.
- xv. ID Fans at Cooling Towers Preventive Maintenance /Replacement of Fan Motor, Gear Box (GB), Hub/ Blades, Angle checking/ setting of Blades of ID Fans
- xvi. Maintenance and Cleaning of All Type of Drums, Vessels at Site.
- xvii. Maintenance of specific equipment of the Effluent collection and treatment section.

b) Details of equipment under the contract are given below according to their plant Unit

The list of equipment shall be furnished after signing a secrecy agreement

- i. Unit 1,2,3,.....
- ii. List of Rotary Equipment for Unit 1,2,3,.....
- iii. List of Static Equipment for Unit 1,2,3,...

c) Operation and maintenance of Electrical equipment.

Sr. No.	Particulars
1	Rectifier Transformers and Rectifier system control Panel
2	Uninterrupted power supply (UPS)
3	33 KV & 3.3 KV OR HT switchboard with Incomers and Outgoing breakers for rectifier transformers and Distribution Transformer.
4	DG Set for Emergency power Supply
5	Battery Charger with battery bank
6	Variable Frequency Drive

d) Round the clock maintenance

- i. Attending the breakdown of electrical equipment during the round the clock operation. Monitoring of critical electrical equipment like rectifiers, HT switchgear, DG Set, LT switch gears, Motors, etc.
- ii. Monitoring the electrical parameters like ampere, voltage, power Etc. of electrical equipment and recorded on a daily basis in shift logbooks and informed to engineer (electrical) for any abnormality if.
- iii. Take out energy meter reading daily and recorded on logbooks and Providing power consumption to process daily at 00:00 HRS.

- iv. Ensure availability of spare materials like fuses, lamps, extension boards etc., for shift operation.
 - v. Isolate/De-isolation the electrical equipment as per work permit/safety permit and tagging on feeders.
 - vi. Connection/ disconnection of electrical equipment as per work permit Also, provide the electrical temporary connection for welding machines and floodlights after ensuring the healthiness of equipment.
 - vii. Shift technicians work as an HT switchboard attendant, which is a Statutory requirement.
 - viii. During a power failure, emergency DG Set power is provided to critical Emergency equipment for the safety of equipment and persons to take safe shutdown. After power resumption and plant start-up, normal power provided to all equipment.
 - ix. Monitoring of critical equipment healthiness and taking corrective action Etc.
- e) Preventive and general shift operation and maintenance
- i. Monitoring the electrical parameters of the critical equipment like rectifier and Critical Motors as a condition monitoring as per instruction of electrical engineers.
 - ii. Pending abnormalities/ Major breakdown job of the shift is to be carried out and reporting to engineer (electrical) as well as Shift in-charge (Process)
 - iii. Preventive maintenance of Lighting Feeders, Transformers, Rectifiers Transformers, Capacitor Bank, LT Motors, Telephones, UPS, PA System, Battery Charger, Polarization Rectifier, etc., which maintenance is generally possible in the day time in general shift.
- f) The details of the electrical equipment to be maintained at CSP Plant
- i. Rectifier Transformers with Rectifier System
 - ii. HT Capacitor Bank
 - iii. Polarization Rectifier System
 - iv. UPS
 - v. 33KV switchboards AND 3.3 KV Switch Boards
 - vi. Distribution Transformers.
 - vii. Lighting Transformers.
 - viii. MCC Panels
 - ix. PCC Panels
 - x. Lighting Feeders & Plant Lighting
 - xi. DG Set
 - xii. HT Motors
 - xiii. LT Motors
 - xiv. Battery Charger and Battery.
 - xv. PA System
- g) Maintenance for Instruments:

Maintenance

- i. Day to day abnormality (breakdown maintenance) to be attended by instrument Engineer/ technicians during the round the clock operation including in shift.
- ii. Preventive maintenance of instruments including major maintenance activities to be carried out in general shift by the respective area Engineer and general Shift Technicians
- iii. Preventive/ breakdown maintenance of control valves, transmitters, and other instruments.
- iv. Miscellaneous instrument jobs like tubing, cabling, instrument removal/installation, etc to be done as and when required during breakdown/ preventive maintenance.
- v. DCS, PLC maintenance by OEM contractors
- vi. Calibration and maintenance of Weighbridge, Products filling stations and weigh scales (Chlorine, hydrogen, caustic soda flakes, HCL filling stations chlorine filling), metering stations (utilities, water, Chlorine, hydrogen gas stations, steam). Instrument laboratories for calibration and testing.
- vii. Maintenance of analyzers
- viii. Shutdown planning and maintenance
- ix. Tools and tackles.

h) The types of the instruments to be maintained at CSP Plant

- i. Level transmitters, Radar type
- ii. PT/DP Transmitters
- iii. Temperature transmitters
- iv. Pressure gauges
- v. Temperature elements
- vi. Temperature Gauges
- vii. H2 in Cl2 detector
- viii. pH sensors
- ix. On-off valves
- x. Control valves
- xi. Variable area flow meters
- xii. Magnetic Flow Meters
- xiii. Mass Flow Meters
- xiv. Mass flow meter (thermal)
- xv. Level switch - tuning fork sensors
- xvi. Ultrasonic Flow meters
- xvii. Vortex Flow meters
- xviii. Load cell

19.6. Estimated Manpower required for Maintenance of GNAL' CSP

Sr. No	Description	No. Officer	No. Technicians	Total Manpower
A	Mechanical			
1	Mechanical Engineers	1		1

2	Mechanical Engineers	5		5
3	Mechanical Technicians (Sr)		8	8
4	Mechanical Technicians (Jr)		8	8
5	Mechanical Technicians (Shift)		4	4
	Total			24
B	Electricals			
1	Electrical Engr (Sr)	1		1
2	Electrical Engineers	3	4	7
3	Electrical Technicians		3	3
4	Electrical Technicians		3	3
5	Electrical Technicians (Shift)		7	7
	Total			21
C	Instrumentation			
	Instrument Engineer(Sr)	1		1
	Inst Engineer (Jr)	3		3
	Inst. Technicians		4	4
	Instrument Technicians		5	5
	Inst. Technicians (Shift)		8	8
	Total			21
D	Civil Engineer	1		1
	Labours (on rate contract basis)			
		1		1
	Total	15	54	69

Note: For scheduled shutdown maintenance the number of manpower / tools and tackles to be worked out at the time of shutdown planning for which the schedule of rates will be applied.

19.7 Estimated Manpower required for quality control function of GNAL's CSP

SN	Description	Officer	Technician/	Total
	Head	1		1
	Chemist	2		2
	analyst	6		6
	Technician		7	7
	Total	9	7	16

19.8 Summary of estimated manpower

SN	Description	Manpower	Remarks
1	Operation	203	
2	Maintenance	69	
3	Quality	16	
4	Safety, administration and other misc	20	
5	Total	308	

20. Annexure 3**(a) List of AMCs / ARCs by the Owner**

LIST OF AMCs / ARCs for Plant Maintenance (Mechanical/Civil)	
SR.NO	TITLE
1	AMC for Screw Air Compressors (OEM) (Non Comprehensive)
2	AMC for Centrifugal Water Chillers (OEM) (Non Comprehensive)
3	AMC for DG Sets (OEM) (Non Comprehensive)
4	Visit Charges for Hiring Service Engineer on Need Basis for Hydrogen Battery Filling Compressors (OEM) (Non Comprehensive)
5	AMC for Chlorine Compressors Maintenance (OEM/Equivalent Agency) (Non Comprehensive)
6	AMC for NI/TI pumps (Non Comprehensive)
7	AMC of Chlorine service pumps
8	ARC for Civil work including AR lining
9	ARC for Painting

LIST OF AMCs FOR PLANT MAINTENANCE-ELECTRICAL	
SR. NO	TITLE
1	Rectifier Transformers and Rectifier system control Panel
2	Uninterrupted power supply (UPS)
4	DG Set for Emergency power Supply
5	Polarization / Battery Charger panels with battery bank *

SR. NO	NAME OF THE INSTRUMENT
1	ICP

2	Gas Chromatograph
3	TOC Analyzer
4	Spectrophotometer
5	Flame Photometer
6	PH / Conductivity / Moisture Meter
7	UV Visible
8	Auto titrator
9	Balance

LIST OF AMCS FOR PLANT MAINTENANCE - INSTRUMENT	
SR. NO	TITLE
1	AMC for DCS maintenance (OEM)
2	AMC for Weigh-bridge maintenance (OEM)
3	AMC for H2 in CL2 / Moisture in CL2 Analyzer (OEM)
4	AMC with OEM for Bagging machines

(b) Indicative list of AMCs / ARCs by O &M Operator

LIST OF AMCs / ARCs FOR PLANT MAINTENANCE-MECHANICAL	
SR.NO	TITLE
1	ARC for CS, SS, Ni Piping and miscellaneous Maintenance work
2	ARC for FRP Piping and Miscellaneous Maintenance
3	ARC for Hot and Cold Insulation
4	ARC for Rubber Lining Work
5	ARC for Pipe Line Thickness Testing, Pressure Vessel Testing, Lifting Tools Testing (Statutory)
6	ARC for In Situ Vibration Analysis
7	ARC for In Situ Dynamic Balancing
8	ARC for Ferrography Analysis of Lube Oil
9	ARC for Valve Repairs

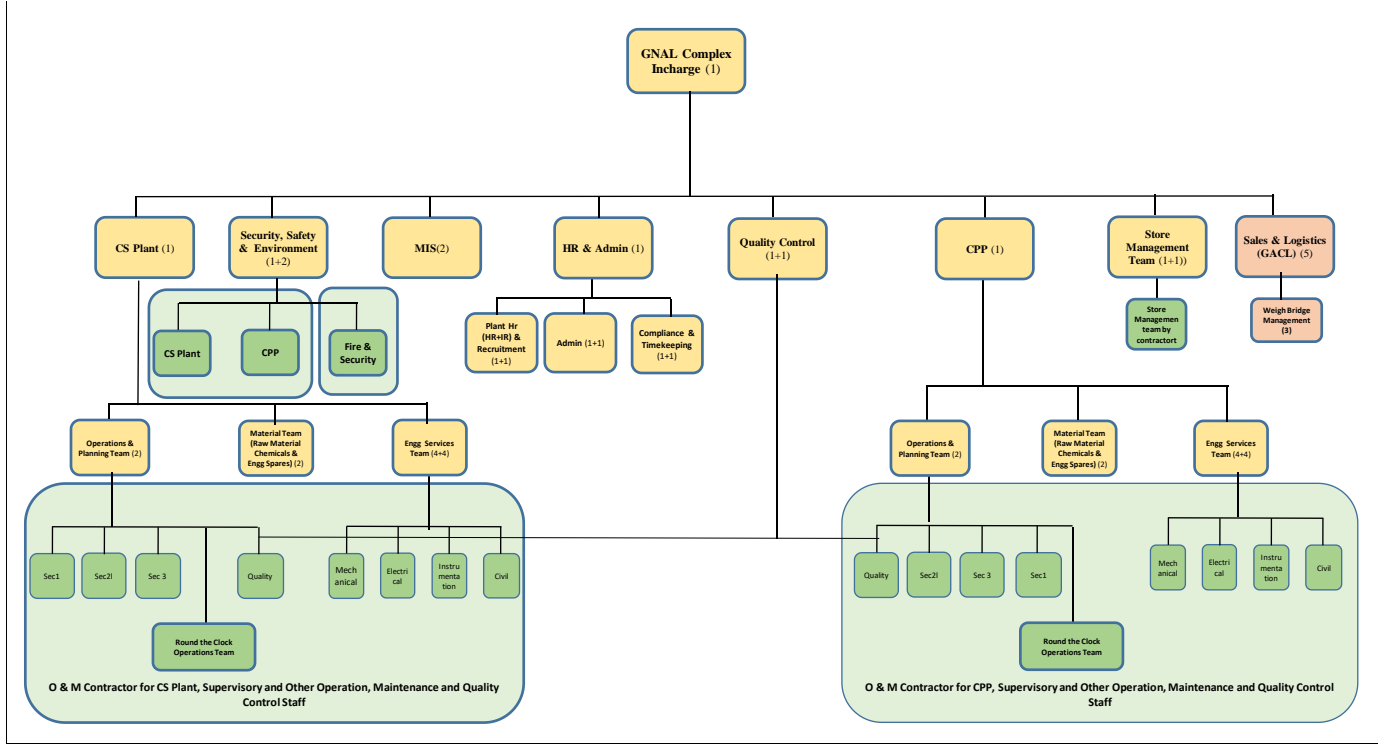
10	ARC for Salt Handling Unit Pulley Rubber Lagging
11	ARC for Salt Handling Conveyor System Belt Jointing by Hot and Cold Method
12	ARC for Maintenance of Crane and Hoist
13	ARC for online sealing for leakages. (service to be obtain by need basis)

LIST OF AMCs FOR PLANT MAINTENANCE-ELECTRICAL	
SR. NO	TITLE
1	33 KV & 3.3 KV OR HT switch board with Incomers and Outgoing breakers for rectifier transformers and Distribution Transformer * (Every year during annual shut down, OEM vendors to be called for maintenance of Switchgears and protection relays with checking of all electrical circuit healthiness. AMC is not required)
2	Variable Frequency Drives * (As and when required, vendor may be called. AMC not required)
3	Transformer oil testing of Rectifier transformer quarterly and other distribution transformer yearly .

LIST OF AMCS FOR PLANT MAINTENANCE - INSTRUMENT	
SR. NO	TITLE
1	AMC for CL2 Bottling Weigh Scales / Crane Scales
2	ARC for Troubleshooting and maintenance of PLC
3	AMC for maintenance of system for stack parameters monitoring / transmission to GPCB / CPCB
4	AMC for maintenance of Control Valves
5	AMC for maintenance of HVAC and air-conditioning
6	AMC for Cabling / Tubing / Misc. maintenance work

21. Annexure 4

GNAL ORGANOGRAM



22. Annexure 5: Indicative Manpower qualification requirements

QUALIFICATION & EXPERIENCE OF PROCESS / OPERATION STAFF					
SR NO	POSITION	NOS	QUALIFICATION	EXPERIENCE	Responsibility
1	Plant Incharge/ Plant Manager		BE/ B Tech or equivalent from a recognized university or institute in Chemical Engineering	1. Minimum 20 years of experience for Plant operation preferably Caustic Soda Plant 2. Knowledge of SAP	1. Overall plant operation, safety of plant, production planning, communication with M/s GNAL 2 To ensure production targets are met. 3. Overall responsibility for quality of products, all intermediate stream, Raw Material and customer complaint 4. Ensuring availability of raw material for production. 5. Responsible to ensure all parameters to run the plant stable and safe. 6. Co ordination with Purchase dept , Marketing Dept and other dept. for running of plant
2	Section Incharge : Brine & Cell House area		BE , B Tech or equivalent from a recognized university or institute in Chemical Engineering	1. Minimum 10 years of experience for operation and maintenance of cell house of Caustic soda plant. 2. Knowledge of SAP	1.Co-ordination with Maintenance, Purchase, Stores and Marketing. 2. Co-ordination with Maintenance department for giving clearance for preventive maintenance or

					breakdown. 3. Overall supervision of operation of sections. 4. Section In charge shall perform the function of Dept. In charge in absence of Dept. Incharge. 5. Responsibility for safety in the Plant. 6. Approval of Inspection results of raw material and finished products.
3	Section In-charge: Chlorine and Hydrogen area		BE , B Tech or equivalent from a recognized university or institute Chemical Engineering	1. Minimum 8 years of experience for operation of Chlorine stream of Caustic soda plant. 2. Knowledge of SAP	1.Co-ordination with Maintenance, Purchase, Stores and Marketing. 2. Co-ordination with Maintenance department for giving clearance for preventive maintenance or breakdown. 3. Overall supervision of operation of sections. 4. Section In charge shall perform the function of Dept. In charge in absence of Dept. Incharge. 5. Responsibility for safety in the Plant. 6. Approval of Inspection results of raw material and

					finished products.
4	Section Incharge : Brine & Cell House		BE , B Tech or equivalent from a recognized university or institute in Chemical Engineering	1. Minimum 8 to 10 years of experience for operation of Caustic evaporation and flaking unit preferably Caustic soda plant. 2. Knowledge of SAP	1.Co-ordination with Maintenance, Purchase, Stores and Marketing. 2. Co-ordination with Maintenance department for giving clearance for preventive maintenance or breakdown. 3. Overall supervision of operation of sections. 4. Section In charge shall perform the function of Dept. In charge in absence of Dept. In-charge. 5. Responsibility for safety in the Plant. 6. Approval of Inspection results of raw material and finished products.
5	Shift In-charge for Control room and plant		BE , B Tech or equivalent from a recognized university or institute in Chemical Engineering	1. 4 to 6 years of experience for working as shift incharge preferably Caustic Soda Plant. 2. Knowledge of DCS operation 3. Knowledge of SAP	1. Ensuring that plant operates smoothly in the shifts to enable achievement of production targets, process, parameters and quality norms. 2. Ensuring safety in shifts. 3. Identifying abnormalities in process, equipment and take or initiate corrective

					<p>actions.</p> <p>4. Preparing abnormality report for maintenance.</p> <p>5. Initiating corrective actions for observed abnormalities, and co-ordination with Maintenance department.</p> <p>6. Preparation of production, consumption and profitability report on daily basis.</p>
6	Panel Engineer for Control room		BE , B Tech or equivalent from a recognized university or institute in Chemical Engineering	1. Minimum 1 year of experience for operation of DCS or Fresh Engineer.	<p>1. Co-ordination with shift In charge, section foreman & section operator.</p> <p>2. Operation of distributed control system</p> <p>3. Maintaining / controlling process parameter.</p> <p>4. Observation and correction of values through DCS.</p> <p>5. Safe start-up and stoppage of plant.</p>
7	Plant Operator		Diploma in Chemical engineering or BSc in Chemistry	1. 2 to 3 years of working experience as operator preferably Caustic Soda plant.	<p>1. Co-ordination with control room.</p> <p>2. Co-ordination for maintenance activities.</p> <p>3. Clearance for process isolation.</p> <p>4. Ensuring safe work practice in the plant.</p> <p>5. Safe start up and stoppage of</p>

					equipment in respective area. 6. Maintaining parameters and record in log book .
8	Junior Operator		Diploma in Chemical engineering or BSc in Chemistry	Fresh	1. Co-ordination with control room. 2. Co-ordination for maintenance activities. 3. Clearance for process isolation. 4. Ensuring safe work practice in the plant. 5. Safe start up and stoppage of equipment in respective area. 6. Maintaining parameters and record in log book.
9	Operator in cl2 bottling.		AOCP	Fresh or 1-2 years similar experience.	

QUALIFICATION & EXPERIENCE OF MECHANICAL MAINTENANCE STAFF				
SR. NO	POSITION	NOS.	QUALIFICATION	EXPERIENCE
1	Head Mechanical		B.E/B.Tech or equivalent from a recognized university or institute in Mechanical Engineering	Minimum 15 Years' relevant experience in Chemical / Chlor Alkali Plants
2	Section Engineers		B.E/ B Tech or equivalent from a recognized university or institute in Mechanical Engineering	Minimum 10 Years' relevant experience in Chemical / Chlor Alkali Plants
3	Shift Engineers		B.E/ B Tech or equivalent from a recognized university	Minimum 5 Years' relevant experience in

			or institute in Mechanical Engineering	Chemical / Chlor Alkali Plants
4	Technicians		Diploma / MMCP in Mechanical Engineering	Minimum 7 Years' relevant experience in Chemical / Chlor Alkali Plants

QUALIFICATION & EXPERIENCE OF ELECTRICAL MAINTENANCE STAFF				
SR NO	POSITION	NOS	QUALIFICATION	EXPERIENCE
1	Head Electrical		B.E./ B Tech or equivalent from a recognized university or institute in Electrical Engineering	Minimum 12 Years' experience in Chloro Alkali Plant
2	Section Head		B.E./ B Tech or equivalent from a recognized university or institute in Electrical Engineering	Minimum 8 Years' experience in Chloro Alkali Plant
3	Engineer / Sr. Engineer (Electrical)		B.E./ B Tech or equivalent from a recognized university or institute in Electrical Engineering	Minimum 3 Years' experience in Chloro Alkali Plant preferable / Chemical Plant / Continuous process plant
4	Asst. Engineer / Engineer for Shift In charge (Electrical)		B.E./ B Tech or equivalent from a recognized university or institute in Electrical Engineering	Minimum 1 Years' experience in Chlor Alkali Plant preferable / Chemical Plant / Continuous process plant
5	Technician for General Shift		Diploma in Electrical Engineering	Minimum 3 Years' experience in Chlor Alkali Plant preferable / Chemical Plant / Continuous process plant
6	Technician for Shift Operations		Diploma in Electrical Engineering	Minimum 3 Years' experience in Chlor Alkali Plant preferable / Chemical Plant / Continuous process plant

QUALIFICATION & EXPERIENCE OF INSTRUMENTATION STAFF AT GNAL				
SR. NO.	POSITION	NOS.	QUALIFICATION	EXPERIENCE
1	Head - Instrument		B.E/ B Tech or equivalent from a recognized university or institute in Instrumentation and Control Engineering	Minimum 10 Years' relevant experience in Chemical Plants
2	Section Engineers		B.E/ B Tech or equivalent from a recognized university or institute in Instrumentation and Control Engineering	Minimum 5 Years' relevant experience in Chemical Plants
3	Shift Inst. Engineers		B.E/ B Tech or equivalent from a recognized university or institute in Instrumentation and Control Engineering	Minimum 3 Years' relevant experience in Chemical Plants
4	Technicians		Diploma in Instrumentation and Control Engineering	Minimum 3 Years' relevant experience in Chemical Plants

QUALIFICATION & EXPERIENCE OF SAFETY STAFF AT GNAL				
SR. NO	POSITION	NOS	QUALIFICATION	EXPERIENCE
1	Head Safety		B.E/B.Tech or equivalent from a recognized university or institute in Chemical Engineering /Environmental Engineering plus Post graduate deploma in Industrial safety	Minimum 10 Years' relevant experience in Chemical Plants
2	Safety Officers		B.E/B.Tech or equivalent from a recognized university or institute in Chemical Engineering / Environmental Engineering plus Post	Minimum 5 Years' relevant experience in Chemical Plants

			graduate deploma in Industrial safety	
3	Safety technicians		BSc/with certificate courses in Safety & Environment	Minimum 3 Years' relevant experience in Chemical Plants

QUALIFICATION & EXPERIENCE OF QUALITY CONTROL STAFF				
SR. NO	POSITION	NOS	QUALIFICATION	EXPERIENCE
1	Head-QCD		M.Sc./ B.Sc. in Chemistry from a recognized university or institute	Minimum 12 Years' relevant experience in Chemical Plants.
2	Officers		MSc/B.Sc.in Chemistry from a recognized university or Institute	Minimum 6 Years' relevant experience in Chemical Plants
3	Analysts		B.Sc. in Chemistry from a recognized university or Institute	Minimum 3 Years' relevant experience in Chemical Plants
4	Lab technicians		B Sc. In Chemistry from a recognized university or Institute	Minimum 1 Year relevant experience in Chemical Plants

Annexure- 6 **Battery limits of Caustic Soda Plant**

Sr. No.	Tie-In Point Number	Description	Battery Limit No	Coordinates	Connection With
1	TP8901	Cooling water supply from BL to Caustic Soda plant	BL-1	1400N, 1648E	Power plant
2	TP8902	Cooling water return from Caustic plant to power plant	BL-1	1400N, 1648E	Power plant
3	TP8903A/B	Emergency cooling waste supply from BL to caustic plant	BL-1	1400N, 1648E	Power plant
4	TP8904	DM water supply from BL to Caustic plant	BL-1	1400N, 1648E	Power plant
5	TP8905	Process water supply from BL to Caustic Plant	BL-1	1400N, 1648E	Power plant
6	TP8906	Drinking water supply from BL to Caustic Plant	BL-1	1400N, 1648E	Power plant
7	TP8907	Fire water supply from BL to Caustic plant	BL-1	1400N, 1648E	Power plant
8	TP8908	Fire water supply from BL to Caustic plant	BL-1	1400N, 1648E	Power plant
9	TP8909	Instrument air supply from BL to instrument air receiver	BL-1	1400N, 1648E	Power plant
10	TP8910	Plant air supply from BL to plant air receiver	BL-1	1400N, 1648E	Power plant
11	TP8911	HP Steam supply from BL to Caustic plant	BL-1	1400N, 1648E	Power plant
12	TP8912	Steam condensate return from steam condensate pump 07P008A/B to power plant	BL-1	1400N, 1648E	Power plant
13	TP8913	Effluent from caustic plant to common ETP	BL-1	1400N, 1648E	Power plant
14	TP8914	32% Caustic from 31E002 32% Caustic cooler to Power plant (DMW plant)	BL-1	1400N, 1648E	Power plant
15	TP8915	32% HCl from HCl Synthesis unit to BL for DM water plant (Power plant)	BL-1	1400N, 1648E	Power plant
16	TP8916	Process condensate from caustic plant to BL for power plant	BL-1	1400N, 1648E	Power plant

17	TP8917	Nitrogen from 77D001A/B nitrogen receiver to BL for CLM plant	BL-1	1400N, 1648E	GACL
18	TP8918	Natural Gas from BL to flaking unit	BL-1	1400N, 1648E	GNAL
19	TP8919	Bleach lye from bleach lye storage 27T001A/B to BL	BL-1	1400N, 1648E	Power plant
20	TP8920	Steam from HCl synthesis unit to CLM Plant	BL-2	1400N, 1654E	GACL
21	TP8921	Hydrogen from Hydrogen De-Oxo unit 42U001 to H ₂ O ₂ plant	BL-2	1400N, 1654E	GACL
22	TP8922	Chlorine gas from Cl ₂ evaporation unit to BL for CLM plant	BL-2	1400N, 1654E	GACL
23	TP8923	32% HCl from HCl Synthesis unit to BL for ECH plant	BL-2	1400N, 1654E	GACL
24	TP8924	Spare	BL-3	1250N, 1291E	Spare
25	TP8925	HCl To GNFC	BL-3	1250N, 1291E	Pipeline (GNFC)
26	TP8926	48% NaOH to CH-17	BL-3	1250N, 1291E	Pipeline (GACL)
27	TP8927	78% H ₂ SO ₄ from storage tank to power plant	BL-1	1400N, 1648E	Power plant
28	TP8928	Caustic to CLM Plant	BL-2	1400N, 1654E	GACL
29	TP8929	Sewage	BL-2	1400N, 1654E	Power plant
30	TP8930	Emergency cooling water supply to Instrument Air Compressor	BL-1	1400N, 1648E	Power plant
31	TP8931	Tail Gas from Chloromethane	BL-2	1400N, 1654E	GACL
32		Storm water discharge	BL5	1650E, 1420.94N	Power plant
33		Storm water discharge		At North side Main road	GIDC storm water canal

BL1,5,6 at the intersection of CSP and CPP
BL 2,3,4,5 at the West boundary of the CSP

Annexure-7

EQUIPMENT LIST				
Sr No	TON	Designation	Number	
			a	b
1	01U001	Salt Handling unit (package unit)	1	0
2	01A001	Salt Storage	1	0
3	02A001A/B	Brine Saturator	1	1
4	02A002	Strainer Pot	1	0
5	02P002	Saturator Sludge Pit Pump with priming pot	1	0
6	02X001	Saturator Sludge Pit	1	0
7	03D001A/B	Ba ₂ CO ₃ Tank with Agitator	1	1
8	03D002A/B	Na ₂ CO ₃ Tank with Agitator	1	1
9	03R001A/B	Precipitation Tank with Agitator	2	0
10	03H001	Electric Hoist	1	0
11	03P001A/B	Ba ₂ CO ₃ Pump	1	1
12	03P002A/B	Na ₂ CO ₃ Pump	1	1
13	04N001	Clarifier	1	0
14	04N001Z01	Clarifier Internals	1	0
15	04F001A/B	Sludge filter (Rotary Vacuum Drum Filter) (package unit)	2	0
16	04D001	Clarified Brine Tank	1	0
17	04D002	Mixing Pot	1	0
18	04D003	Clarifier Sludge Tank with Agitator	1	0
19	04D004A/B	Flocculating agent tank with agitators	1	1
20	04P001A/B	Clarified Brine Pump	1	1
21	04P002A/B	Clarifier Sludge Pump	1	1
22	04P003A/B	Clarifier Sludge Tank Pump	1	1
23	04P004A/B	Flocculent metering pump	1	1
24	05D001	Filtered Brine Tank	1	0
25	05D002	Polished Brine Tank	1	0
26	05D005	Precoat Tank with Agitator	1	0
27	05D006	Alkaline Waste Brine Tank	1	0
28	05D007	Filter Backwash Recovery Tank	1	0
29	05D008	Air Buffer Vessel	1	0
30	05F001A-G	Anthracite Filters with nozzles, anthracite media	6	1
31	05F002A-C	Brine Polishing Filter with Internals	2	1
32	05P001A/B	Filtered Brine Pump	1	1
33	05P002A/B	Polished Brine Pump	1	1

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34	05P004	Backwash Pump	1	0
35	05P005	Precoat Pump	1	0
36	05P006A/B	Alkaline Waste Brine Pump	1	1
37	05P007A/B	Backwash Recovery Pump	1	1
38	05P008A/B	Body Feed Metering Pump	1	1
39	06F001A/B/C	Ion Exchange Columns with Resin and Nozzles	2	1
40	06D001	Pure Brine Head Tank	1	0
41	06D004	18% HCl feed tank	1	0
42	06E001	Brine Heater	1	0
43	06E002	Brine Cooler	1	0
44	06J003	Resin Transfer Device	1	0
45	06P001A/B	18% HCl feed pump	1	1
46	07D001	Anolyte Tank	1	0
47	07D002	Vacuum Tank with Internals	1	0
48	07D003	Bisulphite Head Tank	1	0
49	07D004	Bisulphite Preparation Tank with Agitator	1	0
50	07D005	Anolyte Drain Tank	1	0
51	07D007	Seal water Collection Tank	1	0
52	07D008	Steam condensate Collection Tank	1	0
53	07E001	Vapor Condenser	1	0
54	07F002	Condensate Separator	1	0
55	07P001A/B	Lean Brine Pump	1	1
56	07P003	Bisulphite Filling Pump	1	0
57	07U001-P04A/B	Vacuum Unit (package unit)	1	1
58	07P005	Anolyte Recovery Pump	1	0
59	07P006A/B	Anolyte Pump	1	1
60	07P007A/B	Seal water Recovery Pump	1	1
61	07P008A/B	Steam condensate Pump	1	1
62	08D001	Chlorate Destruction Tank	1	0
63	08E001	Anolyte Heater	1	0
64	08P001A/B	Chlorate Feed Pump	1	1
65	09U001	Sulfate Removal System with Nano Filtration Unit and Crystalliser (Package Unit)	2	0
66	11A001A-H	Electrolyser with 214 elements each	8	0
67	11A001A-HZ01	Cell Rack for 222 elements per Electrolyser with Dual U tube Manometer	8	0
68	11A001A-HZ04	Catholyte Header	8	0
69	11A001A-HZ05	Anolyte Header	8	0
70	11H001	Cell Room Crane	1	0
71	12D001	Membrane Bath with cover	1	0

72	12D001-Z01	Stand for Membrane Spool	1	0
73	12H001	Electric Hoist	1	0
74	12H002	Element Transport Beam	1	0
75	12H003	Element Lifting Beam	1	0
76	12H004	Suction Lift Frame	1	0
77	12V002	Assembly Table Anode	1	0
78	12V002-Z02	Template for Sealing Cord	6	0
79	12V002-Z05	Template for Triclamp	5	0
80	12V002-Z06	Device for Assembly	5	0
81	12V002-Z07	Tools for Tri clamp installation	1	0
82	12V002-Z09	Tools for Elastic Elements	1	0
83	12V002-Z10	Tools for Discharge pipe assembly	1	0
84	12V002-Z11	Membrane Clamp	1	0
85	12V003	Pressure Test Device	1	0
86	12V003-Z04	Manifold for Pressure Testing Device	2	0
87	12V004A/B	Pre-assembly Table	2	0
88	12V005	Portable Pressure Test Device	1	0
89	12V005-Z01	Bubble Test Device	1	0
90	12V006	Tools for Element Assembly	1	0
91	12V007	Intermediate Rack	1	0
92	12V008	Assembly Table Cathode	1	0
93	12V009	Membrane Test Device	1	0
94	12V010	Tools for element alignment	1	0
95	12V011	Test jig for insert pipe	2	0
96	12V012	Membrane Cutting Table	1	0
97	12V013	Washing Rack	1	0
98	12V014	Tools for Blending (Woven mesh)	1	0
99	13X001A-H	4 – Transformers – 8 - Rectifier Units	8	0
100	13X002A-HZ01	Polarization rectifier	8	0
101	13X002A-HZ02	Booster Polarization Rectifier	8	0
102	13X004A-H	DC Breaker	8	0
103	13X005A-H	DC Isolator	8	0
104	21C001A/B	Chlorine Drying Tower with internals	2	0
105	21D001	Under Pressure Safety Vessel	1	0
106	21D002	98% H ₂ SO ₄ Day Tank	1	0
107	21D004	78% H ₂ SO ₄ Day Tank	1	0
108	21D006	Seal Pot	1	0
109	21D007	Seal Pot	1	0
110	'21E002	Chlorine Recuperator	1	0
111	'21E003	Chlorine Cooler	1	0
112	'21E004	Chlorine Chiller	1	0
113	21E004A/B	78% H ₂ SO ₄ Cooler	2	0

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114	'21E006	98% H ₂ SO ₄ Cooler	1	0
115	21F001A/B	Wet Chlorine filter with internals	2	0
116	21F003A/B	Dry Chlorine filter with internals	2	0
117	21P001A/B/C/ D	78% H ₂ SO ₄ Circulation Pump	2	2
118	21P002A/B	98% H ₂ SO ₄ Feeding Pump	1	1
119	21P003A/B	98% H ₂ SO ₄ Unloading & 78% H ₂ SO ₄ Filling Pump	1	1
120	21P004	78% H ₂ SO ₄ Transfer Pump	1	0
121	21T001	78% H ₂ SO ₄ Tank	1	0
122	21T002	98% H ₂ SO ₄ Tank	1	0
123	22D001	Cl ₂ Compressor Cooling Water Tank	1	0
124	22K001	Chlorine Compressor (package unit)	2	0
125	22P001A/B	Cl ₂ Compressor Cooling Water Pump	1	1
126	'23E002	Chlorine Liquefier (Part of Package Unit)	1	0
127	23U001	Refrigeration System for Cl ₂ Liquefaction with liquefier (package unit)	1	0
128	23D001	Expansion Vessel	1	0
129	23D002	Liquid Chlorine Trap	1	0
130	23D003	Liquid Chlorine Trap	1	0
131	24X001	Effluent Pit	1	0
132	24D001	Chlorine Expansion Vessel	1	0
133	24D002	Liquid Cl ₂ Trap	1	0
134	24D003	Chlorine Expansion Vessel	1	0
135	24D005	Chlorine Expansion Vessel	1	0
136	24D006	Liquid Cl ₂ Trap	1	0
137	24D007	Seal pot	1	0
138	24D008	Chlorine Expansion Vessel	1	0
139	24D009	Seal pot	1	0
140	24H001	Crane for Filled Cylinders	1	0
141	24H002	Crane for Empty Cylinders	1	0
142	24K001	Emergency Blower for Cl ₂ Storage	1	0
143	24K002	Emergency Blower for Cl ₂ Filling Area	1	0
144	24P001	Effluent Recovery Pump with Priming Pot	1	0
145	24T001A-E	Liquid Chlorine Storage Tank	4	1
146	24W001A-N	Weighing Scale for Tonner	14	0
147	24X001	Hydro Testing Machine	1	0
148	24Z001A-N	Chlorine Filling Station	14	0
149	24Z003A-N	Chlorine Sniffing Station	14	0
150	25D001	Chlorine Buffer Vessel	1	0
151	25D002	Chlorine Expansion Vessel	1	0
152	25D003	Liquid Chlorine Knock out Drum	1	0

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153	25D004	Chlorine Expansion Vessel	1	0
154	25D005	Chlorine Expansion Vessel	1	0
155	25D006	Chlorine Expansion Vessel	1	0
156	25D007	NCl ₃ Destruction Vessel	1	0
157	'25E002	Chlorine Evaporator	1	0
158	'25E003	Chlorine Super Heater	1	0
159	'25E004	EG Brine Exchanger	1	0
160	25P001A/B	Liquid Chlorine Pump	1	1
161	25P002A/B	EG Brine Pump	1	1
162	25T001	EG Brine Tank	1	0
163	26C001	Final Absorber with internals	1	0
164	26D001	Suction tank I	1	0
165	26D002	Suction tank II	1	0
166	26D003	Under Pressure Safety Vessel	1	0
167	26D004	18% Caustic Head Tank	1	0
168	26D005	Bleach Lye Day Tank	1	0
169	26D006	Emergency Caustic Head Tank	1	0
170	26D007	18% NaOH Tank	1	0
171	'26E002	Bleach Lye Cooler – I	1	0
172	'26E003	Bleach Lye Cooler – II	1	0
173	'26E004	Bleach Lye Cooler – III	1	0
174	'26E005	18% NaOH Cooler	1	0
175	26F001	Ejector I	1	0
176	26F002	Ejector II	1	0
177	26P001A-D	Bleach Lye Circulation Pump	2	2
178	26P002A/B	Bleach Lye Circulation Pump for Final Absorber	1	1
179	26P003A/B	Bleach Lye Transfer Pump	1	1
180	26P004A/B	18% NaOH Transfer Pump	1	1
181	27E002	Bleach Lye Cooler	1	0
182	27F001	Bleach Lye Ejector	1	0
183	27P001A/B	Bleach Lye Filling pump	1	1
184	27T001A/B	Bleach Lye Storage Tank	2	0
185	31D001	Catholyte Head Tank	1	0
186	31D002	Catholyte Tank	1	0
187	31D003	Intermediate Caustic Storage Tank	1	0
188	31E001A	Catholyte Heater	1	0
189	31E001B	Catholyte Cooler	1	0
190	31F001	Hydrogen Separator	1	0
191	31P001A/B	Catholyte Pump	1	1
192	31P002A/B	32% Caustic Transfer Pump	1	1
193	32U001	Caustic Evaporation unit (package unit)	1	0

194	32U002	Caustic Flaking Unit (package unit)	1	0
		Molten salt heater (Furnace)	1	
		Molten salt pump	1	
		Flaker	2	
195	33T001	32% Caustic storage tank	1	0
196	33T002A/B/C	48% Caustic storage tank	3	0
197	33P001A/B	48% Caustic Transfer pump to CH-17	1	1
198	33P002A/B	48% Caustic Loading pump	1	1
199	41A001	Hydrogen Stack-I	1	0
200	41A002	Hydrogen Stack-2	1	0
201	41D002	Hydrogen Buffer Vessel-I	1	0
202	41D003	Hydrogen Buffer Vessel-II	1	0
203	41E002	Hydrogen Cooler	1	0
204	41E003	Hydrogen Chiller	1	0
205	41F001	Hydrogen Filter with Internals	1	0
206	41T001	Hydrogen gas holder	1	0
207	42K001A-D	Hydrogen Compressors (package unit)	3	1
208	42K002A-B	Hydrogen Compressor for Bottling (package unit)	2	0
209	42X001A-B	H ₂ Truck Filling Station	2	0
210	51U001A/B	HCl Synthesis Unit with Receiver tank & transfer pumps (package unit) for producing 32% Liquid	2	0
211	52P001A/B	HCl Pump for Internal Consumption	1	1
212	52P002A-C	HCl Filling Pump	2	1
213	52T001A-F	HCl Storage tank	6	0
214	52U001	HCl Carboy Filling Unit (package unit)	1	0
215	73T001	DM water Tank	1	0
216	73P001A-C	DM Water Pump	2	1
217	74P001A/B	Chilled Water pump	1	1
218	74T001	Chilled Water Tank	1	0
219	74U001	Chilled Water Unit (Package unit)	1	0
220	77D001	Nitrogen receiver	1	0
221	77U001	Nitrogen Generation Unit with Air Compressor (package unit)	1	0
222	78U001	Chlorine Unloading Air Compressor with Drier (package unit)	1	0
223	78D001	Chlorine Unloading Air Receiver	1	0
224	79D001	Plant air receiver	1	0
225	79D002	Instrument air receiver	1	0
226	81D001A/B	Neutralization Tank	1	1
227	81P001A-B	Neutralization Tank Pumps	1	1

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228		Sewage pumps	6	
229		Storm water pumps	3	1
230		MCC, PCC, Instruments PLC etcx		

Annexure-8

List of Insurance by GNAL

- a. Industrial All Risk (IAR) policy covering all assets including stocks at the site against fire and allied perils, acts of God, terrorism, impact damages, lightening, theft and burglary, all electrical, mechanical and electronic breakdown, Business Interruption;
- b. Public Liability Act Policy/Third Party Liability.
- c. Commercial General Liability.
- d. Workman Compensation Act Policy for its Employees.
- e. Group Personnel Accident Policy; for its motor vehicles and
- f. Comprehensive Motor Policy; for its motor vehicles; and
- g. Group Mediclaim Policy for its Employees.

Indicative list of insurances by O & M operator

- a. Public Liability Act Policy/Third Party Liability;
- b. Workman Compensation Act Policy
- c. Group Personal Accident Policy
- d. Comprehensive Motor/ other moving equipment Policy; And
- e. Group Mediclaim Policy
- f. Any Other policy which may O & M operator fund fit for indemnifying the asset of the Owner