

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
WESTERN BENCH AT PUNE
APPEAL NO. 19 OF 2025**

IN THE MATTER OF:

Vijaykumar Karsanbhai Gadhavi & Others

...Appellant (s)

-Versus-

Union of India and Others

...Respondent (s)

INDEX

NDoH: 27.06.2025

S. No.	Particulars	Page No.
1.	Sur Rejoinder on behalf of Respondent No. 4, GHCL Ltd. along with Affidavit	4-26
2.	<u>ANNEXURE R/1</u> – Copy of the map of Critically Vulnerable Coastal Area of the Gulf of Kutch prepared by National Centre for Sustainable Coastal Management, MoEF&CC.	27-28
3.	<u>ANNEXURE R/2</u> – Copy of the photographs of the beach/shoreline of the Soda Ash Project site.	29-37
4.	<u>ANNEXURE R/3</u> - Copy of the article clarifying the nesting habits and frequency of turtle nesting.	38-40
5.	<u>ANNEXURE R/4</u> – Copy of the map showcasing the distance of the geocoordinates mentioned in the photographs annexed in the Appeal and the Rejoinder where allegedly turtles have been found and the Soda Ash project of GHCL	41

6.	<u>ANNEXURE R/5</u> – Copy of the relevant extracts from the GUIDE report mentioning the period of the survey of turtles.	42-61
7.	<u>ANNEXURE R/6</u> – Copy of the google image clarifying the distance between the location of the Soda Ash Plant from Bhaidar Island mentioned in Mr. Satish Bhaskar’s study paper.	62
8.	<u>ANNEXURE R/7</u> – Copy of the Terms of Reference dated 10.08.2021	63-69
9.	<u>ANNEXURE R/8</u> – Copy of the relevant extracts of the EIA Report mentioning the compliance with the conditions in the Terms of Reference.	70-88
10.	<u>ANNEXURE R/9</u> – Copy of the relevant extracts of the EIA Technical Guidance Manual	89-136
11.	<u>ANNEXURE R/10</u> – Copy of the detailed maps clarifying that there are no Protected Areas within 10 km of Soda Ash project	137
12.	<u>ANNEXURE R/11</u> - copy of the Judgment in the case of Prafull Samantray v. Union of India and Others [2023 SCC OnLine NGT 4874]	138-157
13.	<u>ANNEXURE R/12 (Colly)</u> - Copy of the relevant land record documents clarifying the land use in Survey No. 459 and 548.	158-165
14.	<u>ANNEXURE R/13 (Colly)</u> - Copy of the map showcasing the distance of the coral reefs from the Soda Ash Plant.	166-169

15.	<u>ANNEXURE R/14</u> – Copy of the Study report titled “Coral Reefs in India – status threats and conservation measures”, 2012, by MoEF&CC and IUCN, 2012.	170-173
16.	<u>ANNEXURE R/15 (Colly)</u> - Copy of the relevant extracts of relevant extracts from the CSIR NEERI report as well as the GUIDE report	174-195
17.	<u>ANNEXURE R/16 (Colly)</u> – Copy of the EDS raised by GCZMA on 01.02.2022 and the response of GHCL on 29.11.2022 and 29.04.2023	196-201
18.	<u>ANNEXURE R/17</u> – Copy of the relevant extracts of the Environment Protection Rules, 1986, along with the prescribed standards,	202-205
19.	<u>ANNEXURE R/18 (Colly)</u> – Copy of the detailed presentation of the CSR activities along with the photographs	206-256

20. Proof of Service

257

Place: Pune

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**SUR REJOINDER ON BEHALF OF RESPONDENT NO. 4, GHCL
LTD. TO THE REJOINDER OF THE APPELLANT**

MOST RESPECTFULLY SHEWETH

1. That this Hon'ble Tribunal is currently seized of the abovementioned Appeal which challenges the Environmental Clearance dated 12.12.2024 granted to Greenfield Chemical Complex, GHCL Ltd., (Respondent No 4 herein) for the proposed production of 11,00,000 TPA capacity of Light Soda Ash (LSA), 5,00,000 TPA capacity of Dense Soda Ash (DSA) and 2,00,000 TPA capacity of Sodium Bicarbonate in Village Bada, Taluka Mandvi, Kutch District of Gujarat. It is alleged, albeit wrongly, that the Environmental Clearance dated 12.12.2024 has been granted in violation of the EIA Notification, 2006, the siting criteria in the Technical EIA Guidance Manual for Soda Ash Industry, 2010, Species Best Interest Principle and the Precautionary Principle.
2. That the Greenfield Chemical Complex, GHCL Ltd. (hereinafter referred as the "**answering Respondent**"), who has been arrayed as Respondent No. 4, has submitted its Reply Affidavit on 22.03.2025 in the present Appeal clarifying that Project Proponent is responsible for the implementation of the Project for the proposed production of 11,00,000 TPA capacity of Light Soda Ash ("**LSA**"), 5,00,000 TPA capacity of Dense Soda Ash ("**DSA**") and

2,00,000 TPA capacity of Sodium Bicarbonate (hereinafter referred as “**Soda Ash Project**”) in Village Bada, Taluka Mandvi, Kutch District of Gujarat. Further, the said Soda Ash Project is being implemented in accordance with the law and the allegations raised by the Appellant in the Appeal are without any merit in facts as well as law. The submissions of the Reply Affidavit are not being reiterated for the sake of brevity.

Preliminary Objections to the submission of new facts and documents in the Rejoinder

3. That on 09.06.2025, the Appellants have filed a Rejoinder putting on record additional documents and submissions which were not part of the original Appeal and have sought to enlarge the scope of the Appeal in contravention of the settled principles of law. The Appellants in their Rejoinder have raised allegations pertaining to the impact on algal communities, sand dune erosion, presence of ponds, alleged violation of MoEF&CC Office Memorandums, submission of RTI applications and response of the Forest Department, photographs, which were not part of the original Appeal and the allegations raised therein.
4. That it is a well-settled principle of law that no new facts can be included in the Rejoinder without amendment of the original application/appeal. Rule 16 of the National Green Tribunal Rules 2011 also specifies in clause (7) that parties may be permitted to amend the pleadings in the same manner as provided under Order 6, Rule 17 of the Civil Procedure Code, 1908. However, the Appellants without seeking the said permission have attempted to submit new facts and grounds of challenge to the prior EC dated 12.12.2024 in their Rejoinder without compliance with Rule 16 of the NGT Rules, 2011. This itself is a ground alone to reject all the new submissions made where an attempt is being made to give a new colour to the case, which is not

permissible and therefore violates the principles of Order 6 Rule 17 of CPC. In view of the above, the answering Respondent seeks liberty of this Hon'ble Tribunal to file the present Sur Rejoinder to submit its detailed response to the additional allegations and new factual evidence submitted in the Rejoinder, if at all such additional facts and grounds are admitted through a due process of law. Thus, these submissions are being filed with the above contentions and in abundant precaution. That it is also obvious that these are dilatory tactics from the Appellant to delay the process of adjudication which is otherwise ripe for final arguments and adjudication by this Hon'ble Tribunal.

Preliminary Submissions on the allegations in the Rejoinder

5. That the Rejoinder may be discarded to the extent it raises new facts, new grounds without following the due process of law as highlighted below.
6. That the Appellants in the Rejoinder have wrongly alleged that the Environmental Clearance granted to the answering Respondent is not in accordance with the procedure and the mandate prescribed under the Environment Impact Assessment Notification, 2006. The Appellants have consistently tried to mislead this Hon'ble Tribunal, for reasons best known to them, and have submitted incomplete facts and position of law. The submissions of the Appellants in the Rejoinder are being responded to under the following sub-heads, for ease of reference of this Hon'ble Tribunal and to avoid repetition for the sake of brevity. That any contention which has not been specifically responded in the present Sur Rejoinder are herewith denied and are not to be construed as having been accepted by the answering Respondent as if traversed seriatim.

a. The Minutes of the 84th and 87th Meeting of the Expert Appraisal Committee were duly within the knowledge of the Appellants

7. That the Appellants have wrongly stated the absence of knowledge of the 84th and 87th Minutes of the Expert Appraisal Committee by relying upon the timeline of the Soda Ash Project proposal on the parivesh website. It is pertinent to highlight that Annexure A1 of the Appeal, where the Environmental Clearance dated 12.12.2024 of the answering Respondent has been annexed, @ page 106-108 discuss in detail the proceedings of the 84th and the 87th minutes of the Expert Appraisal Committee. Thus, the omission of the Appellants to mention the same in the Appeal and thereafter cover up the failure/suppression of the facts by relying on the timeline details is misplaced and clearly highlights the lackadaisical attitude with which the Appellants have approached this Hon'ble Tribunal.

b. The Soda Ash Project does not fall within the Critically Vulnerable Coastal Area

8. That the Appellants have relied upon the Judgment of the Hon'ble Supreme Court in Kapico Kerala Resorts (P) Ltd. v. State of Kerala, reported in (2020) 3 SCC 18 as well as the provisions of the Coastal Regulatory Zone Notification of 2019 to allege that the entire Gulf of Kutch is a Critically Vulnerable Coastal Area. It is pertinent to note that, unlike in the case of the Vembanad Lake, the subject matter of the Kapico Kerala Resorts (P) Ltd case, the MoEF&CC has clarified the areas which will be part of the Critically Vulnerable Coastal Area in the Gulf of Kutch. On plotting the project coordinates on the said approved map of MOEF&CC through the NCSCM, it becomes clear that the Soda Ash Project of the answering Respondent does not fall within the areas identified as Critically Vulnerable Coastal Area in the

Gulf of Kutch. The same has already been explained in detail in the Reply dated 22.03.2025 of the answering Respondent. The Soda Ash Project of the answering Respondent is about 90 Kms away from the approved CVCA areas/boundaries as per the NSCCM map. The true copy of the map of NSCCM approved CVCA areas and answering Respondent project location is marked and annexed herein as **ANNEXURE R/1**. Moreover, the Kapico Judgment merely reaffirms the observations of the Kerala High Court and has not specifically dealt with the issue of Critically Vulnerable Coastal Areas. It is also important to emphasize that the reliance by the Appellants on the Coastal Regulatory Zone Notification of 2019 is misplaced as the same is not applicable in the Gulf of Kutch till date due to absence of finalized Coastal Zone Management Plans. It is the 2011 CZMP which is still applicable in the state of Gujarat like many other states.

c. There are no Turtle Nesting Sites at the site of the Soda Ash Project

9. That the Appellants have repeatedly alleged, without any basis in facts and law, that the Soda Ash Project of the answering Respondent also includes turtle nesting site by relying upon the RTI response of 2022 and 2025 of the Forest Department, photographs as well as some articles of different scholars. At the outset, the answering Respondent urges this Hon'ble Tribunal to take strict note of the conduct of the Appellants, who have submitted incomplete information and misleading photographs from another place for alleging that the Soda Ash Project site at Bada village is the turtle nesting ground. The answering Respondent seeks liberty to submit recent photographs from the site with coordinates, which confirm that the photographs annexed by the Appellants in the Appeal as well as the Rejoinder do not pertain to the project site of the answering Respondent. In fact some of those photographs

submitted by the Appellant do not have coordinates and some of those photographs which have coordinates are not from the site in question. Further, the recent photographs being submitted by the answering Respondent herein clarifies that the high tide line covers the entire beach, the sea coast is rocky and the beach is filled with tree and other debris due to frequent storms, thereby making the said site unsustainable for any form of turtle nesting. The copy of the photographs are marked and annexed as **ANNEXURE R/2**.

10. That further, the reliance on the RTI response of 2022 and thereafter the recent RTI response dt. 10.01.2025 of the Forest Department to allege the presence of turtle eggs, dead turtles is misplaced and exaggerated. At the outset, the RTI response does not clarify the location of the presence of turtle eggs, turtles or dead turtles as the entire Mandvi taluka has been included. Further, specifically the RTI response of March 2025 states that 8682 turtle eggs were found on Mandvi beach between 2011-12 to 2023-24 and 33 dead turtles along the Mandvi Beach. It is pertinent to note that the said figure clearly highlights that the nesting of turtles is sporadic as a single turtle in one nesting period lays about 100-200 eggs. Thus, the figure of 8682 eggs over ~~four~~ Twelve years and through-out the length of the Mandvi coast in question spread along an area of about 50-55 Kms, where only a small stretch of 1.5 km is being used in parts by the answering respondent for its entire project, clearly highlights it is not a major turtle nesting site. The same has been confirmed by ZSI, GUIDE and CSIR NEERI in their Reports as well as through field visits of the Sub Committee appointed by the EAC, the details of which have been given in the comprehensive Reply dated 22.03.2025 of the answering Respondent. Copy of the article clarifying the nesting habits and frequency of turtle nesting is marked and annexed as **ANNEXURE R/3**.

11. That it is important to emphasize that the photographs annexed in the Appeal

as well as the Rejoinder are coordinates of an area three kilometers away from the site of the answering Respondent. The copy of the map showcasing the distance of the geo-coordinates where the turtle was found and the Soda Ash project of GHCL Ltd. is marked and annexed as **ANNEXURE R/4**.

12. That further, the Appellants in their Rejoinder have relied upon a paper by Satish Bhaskar titled “the Distribution and Status of Sea Turtles in India”, to state that the study period/survey in the ZSI study and the GUIDE study was conducted during off season and thereby question the veracity of the said report. At the outset, it is pertinent to note that the GUIDE study was conducted for the turtle nesting period from June 2022 to January 2023. The relevant extracts from the said report, mentioning the period of the survey is marked and annexed herein as **ANNEXURE R/5**. Further, the paper by Mr. Satish Bhaskar was published in 1984 and the data being relied upon is more than 40 years old. The research paper also shows that the study pertains to Bhaidar Island, which is on the Southern shoreline of Kutch and 49-50 km away from the project of the answering Respondent. The copy of the Google image plotting the distance of the project of the answering Respondent and the Bhaidar Island is marked and annexed as **ANNEXURE R/6**

d. The Terms of Reference have been duly incorporated and complied with at the time of preparing the EIA Report

13. That the Appellants have alleged that the Work Order was allotted to NEERI in 2018, prior to the application and grant of Terms of Reference, which is not in accordance with the EIA Notification, 2006. It is pertinent to note that the EIA Notification, 2006 does not restrict finalization of the Consultant or grant of Work Order prior to the grant of Terms of Reference. The Standard Terms of Reference for each sector are in the public domain for reference and for

commencing the preparation of the project proposals and application for Terms of Reference, which also requires a pre-feasibility report. Further, during the stage of scoping, the Terms of Reference, both standard and specific were prescribed by the Ministry of Environment, Forest and Climate Change to the answering Respondent on 10.08.2021. The said Terms of Reference have been duly incorporated and complied with and are part of the EIA report as prepared by CSIR-NEERI as well as subsequently revalidated by TR Associates. Thus, the EIA report has been prepared based on the Terms of Reference granted on 10.08.2021. The True copy of the Terms of Reference dated 10.08.2021 is marked and annexed as **ANNEXURE R/7**. The relevant extracts of the EIA Report mentioning the compliance with the conditions in the Terms of Reference is marked and annexed as **ANNEXURE R/8**.

e. The EIA Report has been prepared by accredited Consultants

14. That at the cost of repetition, it is submitted that at the time of grant of Work Order to NEERI, there were no specific accredited Consultants for Soda Ash. The answering Respondent had also written to the MoEF&CC enquiring about the same. It is only subsequently in 2019-2020 that TR Associates was awarded the accreditation for soda ash. Such accreditation are not immediately communicated to project proponents in general. Further, the project proponent, after the initial report was prepared by CSIR NEERI, has subsequently got the said EIA report revalidated by TR Associates, who was accredited by then, and thus cannot be said to be a faulty report. The EIA Notification, 2006 does not bar revalidation of reports by accredited Consultants. The reliance on Judgment of the Hon'ble NGT in Sreeranganathan K.P vs. Union of India & Ors. 2014 SCC OnLine NGT 5631 is misplaced as the report prepared in the said case was faulty since the EIA

Consultant did not have any accreditation from NABET QCI and the same fact was not considered by the EAC. In the present case, sector specific accreditation was soda ash was not allotted to any Consultant till 2019-2020. Prior to the establishment of a separate Soda Ash sector by QCI-NABET, Soda Ash was part of the Chloro-Alkali sector, for which CSIR-NEERI was a NABET-accredited consultant. Earlier, EIA study of Soda ash industry was carried out by only Chlor Alkali Approved consultant and Environmental Clearance was granted by MoEF&CC They have carried out EIA for Soda ash industry. Further, the EAC after examining the said aspect in its first meeting itself recommended that TR Associates may be engaged for revalidating the EIA Report prepared by CSIR- NEERI, which was complied accordingly. It is surprising that the Appellant has not been able to pinpoint any substantial issue with regard to the quality of the EIA Report and is instead raising and hair-splitting procedural issues, which has otherwise been taken care by the due process of EAC.

15. That further, specifically with respect to the allegation of the absence of the accreditation of National Institute of Oceanography, it is humbly reiterated that NIO was engaged to undertake additional studies with respect to marine components of the EIA report as a matter of abundant precaution. Further, the said report was prepared in collaboration with CSIR-NEERI, which remains permissible as per the letter of NABET which allows NIO to undertake the marine components in collaboration with accredited consultants. The contents of the Reply Affidavit are reiterated as a part of the response to the above allegations and are not being repeated for the sake of brevity.

f. The EIA report has been prepared in accordance with the Technical EIA Guidance Manual

16. That further, with respect to the criteria mentioned in the Technical EIA Guidance Manual, it has been mentioned in the Reply Affidavit that the Soda Ash Project of the answering Respondent is compliant with the criteria mentioned therein. It is also pertinent to mention that the siting guidelines in the EIA Technical Manual itself mention that in some situations, adhering to these guidelines is difficult and unwarranted. However, they may be kept in the background while making decisions. Accordingly, the Guidelines have been considered at the time of preparation of the EIA Report including the non-feasibility of the establishment of the project in any other area. The relevant extracts of the EIA Technical Guidance Manual are being annexed as **ANNEXURE R/9**.

17. That further, in the Reply of the answering Respondent, it has been clarified that there is no National Park or Wildlife Sanctuary or any other protected area in the vicinity of the Soda Ash Project. The detailed maps clarifying that there are no Protected Areas within 10 km of Soda Ash project is marked and annexed collectively as **ANNEXURE R/10**.

g. The Public hearing has been conducted in accordance with the law

18. That the Appellants have alleged that the public hearing was undertaken in a coercive environment and the EIA report presented for public hearing was faulty as it was prepared by unaccredited consultants. The presence of police during the public hearing was essential to ensure compliance with law and order since the first public hearing was forcefully disrupted by the Appellants and their associates. However, there were numerous comments/queries raised during the public hearing, including those of the Appellants and the presence

of police did not lead to any coercive action or conduct which inhibited the public from raising their grievances. In this regard, the answering Respondent relies on the contentions of Respondent No 3-GPCB which is the nodal authority to conduct the public hearing along with the District Magistrate and Collector.

19. It is reiterated that revalidated EIA Report is not required to be placed before the public for a fresh public hearing as per the EIA Notification, 2006. This Hon'ble Tribunal in the case of Prafull Samantray v. Union of India and Others [2023 SCC OnLine NGT 4874] has held that not conducting a fresh public hearing after revised EIA Report will not be fatal to the grant of Environmental Clearance. The copy of the Judgment is marked and annexed herein as ANNEXURE R/11.

h. The Procedure as per the MoEF&CC Office Memorandum dated 29.11.2022 has been followed.

20. That the Appellants have wrongly stated that there has been no compliance with the Office Memorandum dated 29.11.2022 which requires the Expert Appraisal Committee to refer and consider the comments of CRZ specific sector of the EAC, where projects fall within the CRZ, prior to the grant of Environmental Clearance. The Appellants are again trying to mislead this Hon'ble Tribunal by presenting incorrect facts. The comments of the CRZ sector specific EAC were duly solicited as is evident from the 78th minutes of the EAC dated 30.04.2025 annexed in the Appeal at page 301. The concluding remarks of the EAC at page 328 *inter alia* states that the proposal of the answering Respondent was deferred to obtain views/comments of the CRZ division. Thereafter, in the 80th meeting of the EAC on 07.06.2024, the EAC deliberated on the comments of the CRZ division before recommending the

grant of Environmental Clearance. (Refer page 1992 of the Reply Affidavit of Respondent No. 4, GHCL Ltd.) The baseless submissions of the Appellants clearly highlights that the Appellants have no legal grounds for challenging the Environmental Clearance of the answering Respondent and have resorted to submission of incomplete facts and position of law to mislead this Hon'ble Tribunal. This Hon'ble Tribunal may take strict note of the said conduct of the Appellants.

i. There are no lakes/water bodies within the land allotted for the Soda Ash Project.

21. That the Appellants have further alleged in the Appeal that the answering Respondent has failed to disclose the presence of two ponds at Survey No.459 and 548 to the EAC as well as to the Sub Committee during its field visit of the site for the Soda Ash Project. It is pertinent to note that both, Survey No. 459 and Survey No. 548 in land record documents refer the land use as 'Po. Kh. A' which means particular land is not suitable for cultivation due to its poor quality (It is important to note that the categorization Po Kha B means a water body, lake among others which is being confused by the Appellant). The relevant land record documents clarifying the land use are marked and annexed collectively herein as **ANNEXURE R/12 (Colly)**. Hence, the Appellants have wrongly stated that there has been non-disclosure or information by the answering Respondent with respect to the presence of ponds within the project site of the proposed Soda Ash Plant. Thus, the minimum distance from ponds as per the siting criteria of the Gujarat Pollution Control Board is not applicable herein as the said Survey No.(s) are not classified as ponds in the government land record documents.

j. The direct and indirect threats/impacts of the Soda Ash project on coral reefs, sea turtles, sand dune erosion, rise in sea temperature, and threat to algal communities have been duly looked into by the Respondent No. 4, GHCL Ltd.

22. That the Appellants have further alleged that the establishment of the Soda Ash Plant will lead to increase in sea level temperature, impact the corals reefs, sea turtles, algal communities and cause sand dune erosion. It is submitted ad nauseum that there are no sea turtle sites, coral reefs at the proposed site of the Soda Ash Plant. The abovementioned submissions with respect to presence of sea turtles are being reiterated and are not being repeated for the sake of brevity.

23. That specifically with respect to the alleged presence of coral reefs, it is reiterated that there are no coral reefs present in the said area as is evident from the map of MoEF&CC where dedicated coral reefs have been plotted. The said map clarifies the distance of the coral reef from the proposed site of the Soda Ash Plant and thus will not be impact directly or indirectly from the activities of the answering Respondent. The map prepared by NCSCM, MoEF&CC listing the coral reef sites in Kutch and the distance of the same from the site of the Soda Ash Plant is marked and annexed as **ANNEXURE R/13 (Colly)**.

24. That further, the Appellants have relied upon a study titled a New Discovery of Coral Rubbings in the North Western Gulf of Kutch, Gujarat, Western India – GIS based evaluation by Ocean University of China. At the outset, the veracity of the said report is questioned given that the same has been prepared by a non-accredited foreign university. The Study report titled “Coral Reefs in India – status threats and conservation measures”, 2012, by MoEF&CC and IUCN clearly states that coral reefs in the Gulf of Kutch are largely on the

Southern Shore of the Gulf and thus does not include the site of the Soda Ash Plant. The copy of the relevant extracts said Study is marked and annexed as **ANNEXURE R/14**.

25. That a comprehensive impact analysis on marine biodiversity, including algal communities, was undertaken by CSIR NEERI, TR Associates and specifically by CSIR-NIO to ensure that all the requisite mitigation measures are in place in case there is any impact on the marine biodiversity. However, the said EIA and Marine EIA Reports have not highlighted any adverse impact on the marine biodiversity from the project of the answering Respondent as answering Respondent will maintain environmental norms as prescribed by CPCB/ GPCB. The relevant extracts of the EIA and the Marine EIA vis a vis the impact on marine biodiversity are annexed in the Reply Affidavit of the answering Respondent.

26. That further, apart from CSIR NEERI, the Gujarat Institute of Desert Ecology (GUIDE) was specifically hired for undertaking an analysis of the impact on sand dunes from the project activities of the answering Respondent. The GUIDE in its report has clearly stated that the project activities per se will not impact the sand dunes. However, for abundant precaution, the GUIDE has prepared a sand dune conservation plan, which requires the answering Respondent to monitor the sand dunes and revegetate it, apart from removing the debris for ensuring their maintenance. The same will be undertaken by the answering Respondent during and post the construction of the Soda Ash Plant. The relevant extracts from the CSIR NEERI report as well as the GUIDE report are marked and annexed collectively here as **ANNEXURE R/15 (Colly)**.

k. The pipelines for sea water intake and outfall will not adversely impact the terrestrial or marine biodiversity.

27. That the Appellants have further raised the allegation that the sea water pipelines are an integral part of the project and hence the entire project is in CRZ area and not just the pipelines. It is further alleged that the intake and outfall from the pipelines have the capacity of severely damaging the marine biodiversity in the area.

That the answering Respondent in its Reply Affidavit has submitted at para 53 and 54 that an application was filed before the Gujarat Coastal Zone Management Authority and subsequently a superimposed map was prepared by the Anna University (an accredited University by the MOEF&CC to prepare CZMP) for clarifying the areas of Intake/ Outfall pipelines of the Soda Ash Project falling within the CRZ area. Thereafter, the Gujarat CZMA has granted the CRZ Clearance. In the CRZ Clearance of 26.12.2023, Gujarat CZMA has mentioned that certain queries were raised to the Project Proponent (Respondent No. 4 herein) on 01.02.2022 which were duly responded on 29.11.2022 and 29.04.2023. The said queries and responses are not on record before this Hon'ble Tribunal. The same are being placed on record for the ready reference of this Hon'ble Tribunal herein at **ANNEXURE R/16 (Colly)**. In any case, if there is a grievance against any such clearance a remedy is available in law and which has not been exercised. Hence, these contentions may be discarded as such, by this Hon'ble Tribunal.

28. That the Respondent No. 4 in its Reply Affidavit has clarified that primarily the pipeline is falling in the un-reserved Forest area and the CRZ area. Accordingly, the Forest Clearance has been obtained on 04.01.2023 and the CRZ clearance has been obtained on 26.12.2023. The Respondent No. 4 additionally seeks to clarify that the pipeline will be established by utilising

the micro-tunnelling/pipe jacking technique, leading to the establishment of the pipeline fifteen meters below the surface and without any impact on the forest area or the CRZ area. As stated earlier, any challenge to a Forest Clearance or a Coastal Regulation Zone Clearance is a subject matter of a separate appeal and need not be adjudicated in this Appeal and is therefore not maintainable.

29. That the said pipelines will be utilised for sea water intake and effluent disposal facilities. The waste water discharged from the pipeline will first be treated with seawater for reduction in temperature and pH, as per the methodology prescribed in the EIA Technical Guidance Manual for Soda Ash Plants. At the time of discharge, the wastewater would be equal in temperature as well pH, among other parameters, to that of the seawater. Further, the effluent/wastewater discharged will be tested periodically to ensure the standards as prescribed in the Environment Protection Rules, 1986 for soda ash plants as per the conditions of the Consent and the Annual Report regarding the same under the Environment Protection Act, 1986 and the Environment Protection Rules, 1986 will be submitted to the Gujarat State Pollution Control Board for monitoring. The relevant extracts of the Environment Protection Rules, 1986, along with the prescribed standards, is marked and annexed herein as **ANNEXURE R/17**. In any case, all these aspects have been thoroughly examined by the EAC, GCZMA and conditions of such clearances clearly mandate the obligation to comply with the technical EIA Manuals in this regard. As stated earlier, the same will be monitored by the periodic reporting as mandated by the EIA Notification as well as during Consent renewals or even otherwise through periodic checks by regulators responsible for such clearances.

30. That further, at the time of construction of the pipeline, there will be no impact on the forest land or the shoreline as well as the CRZ area as an alternative route will be utilised that goes from outside the forest land as well as the CRZ area for undertaking the construction of the pipeline, which has been approved by competent authorities. The Tunnelling will be extended beyond the intertidal zone and hence there will be no impact on the shoreline or to the sand dunes. As stated earlier, the mitigation measures of the impact of the tunnelling on the sand dunes or the shoreline has been duly incorporated in the EIA report by CSIR – NEERI as well as by the National Institute of Oceanography, GUIDE and TR Associates. The said observations are not being reiterated for the sake of brevity.

Response to the preliminary submissions in the Rejoinder

31. That in response to the preliminary submissions in the Rejoinder of the Appellant from Page 3230 to 3242, the submissions made in the preliminary submission of the Sur Rejoinder are being reiterated and are not being repeated for the sake of brevity.

Response to the para-wise response in the Rejoinder to the Reply Affidavit of Respondent No. 4

32. That the submissions in para 2-3, at pages 3243 and 3244 of the Rejoinder are denied as wrong, false and devoid of all merit. The Appellants are clearly interested parties and not residents of Bada Village, who have approached this Hon'ble Tribunal for reasons beyond environmental considerations. The Hon'ble Supreme Court in the case of Uttar Pradesh & Ors. v. Uday Education and Welfare Trust and Ors. (2022 SCC OnLine SC 1469) has clearly stated that this Hon'ble Tribunal has to consider the bonafide of the litigant

approaching the Hon'ble Tribunal especially where the rights of many are likely to be adversely impacted. Thus, the Hon'ble Supreme Court has clarified the requirement of adjudicating who is an aggrieved person within Section 18 of the National Green Tribunal Act, 2010 in an Appeal under Section 16. The Appellants cannot place reliance on Save Mon in view of the Judgment of the Hon'ble Supreme Court, which has recently settled the position of law. Further, the failure of the Appellants in disclosing before this Hon'ble Tribunal the Writ Petition filed by them before the Hon'ble High Court of Gujarat clearly highlights that the Appellants wanted to suppress this material information to mislead this Hon'ble Tribunal and have now approached this Hon'ble Tribunal challenging the veracity of the same public hearing, which was also challenged before the High Court. This Hon'ble Tribunal may note the conduct of the Appellants, who have been misleading and misrepresenting facts and the position of law before this Hon'ble Tribunal.

33. That in response to the contents of para 4, the contents of the preliminary submissions are being reiterated as a response and are not being repeated for the sake of brevity. It is however pertinent to emphasise that the reference of the 84th and the 87th Meeting is there in the impugned Environmental Clearance itself and is annexed in their Appeal as the first annexure. It is surprising that the Appellants claim want of knowledge of the said minutes when the same are not only referred but also discussed in detail in the Environmental Clearance dated 12.12.2024. This clearly highlights the casual and lackadaisical attitude with which the Appellants have approached this Hon'ble Tribunal and have initiated a frivolous litigation against a nationally important project for reasons best known to the Appellants.

34. That in response to paras 5-8, it is humbly submitted that the Appellants are

clearly not producing the position of facts and law correctly before this Hon'ble Tribunal, which is evident from the failure of the Appellants in producing the minutes of the 80th, 84th and 87th Meetings of the EAC even though the same were mentioned in the Environmental Clearance. Further, the Appellants claim the Writ Petition before the Hon'ble High Court of Gujarat pertained to challenge to public hearing on grounds different from those raised before this Hon'ble Tribunal however again the said details were not produced before this Hon'ble Tribunal. In another instance, the Appellants alleged that the CRZ Division comments have not been sought for and considered by the EAC as per the OM dated 22.11.2022, however, the same was explicitly stated and covered by the EAC in its 78th and 80th meetings. More importantly, the Appellants have been repeatedly submitting photographs to allege that the site is a turtle nesting site. However, the photographs do not pertain the site of the answering Respondent and are 3-4 km away. Further, Appellant No. 3 has also bought a land admeasuring 21.19 acres in Survey No. 426 purposefully in the project site through the land aggregator appointed by the answering Respondent merely to create obstructions and impediments to the ongoing project which has also been concealed for reasons best known to them. These facts clearly highlight that the bona fides of the Appellants are questionable, who have misrepresented the facts and position of law before this Hon'ble Tribunal to mislead this Hon'ble Tribunal.

35. That in response to the contents of para 9, it is reiterated at the cost of repetition that the intake and outfall pipelines will not create any adverse impact on the marine biodiversity. The intake system is designed to prevent entrainment and entrapment of marine life, including fish and juvenile and sub adult turtles. The low velocity (0.15m/s) fish escape velocity minimizing the risk of smaller organisms being drawn in. Additionally, 100 mm coarse bar

screens act as a physical barrier, preventing larger marine life from entering the intake. The elevated intake position approx. 2.00 m above the seabed further reduces interactions with marine species, ensuring safe and environmentally conscious design. The Appellants are put to strict proof with respect to the technical allegations pertaining to the intake and outfall pipeline, which have been made in the Rejoinder without an iota of evidence to support the same.

36. That in response to para 10, the submissions in para 33-35 are reiterated and are not being repeated for the sake of brevity.

37. That in response to para 11, it is humbly submitted that the answering Respondent has undertaken numerous studies from institutions of national and international repute over a period of four to five years before the establishment of the project to ensure environmental considerations are duly addressed before the Soda Ash project can be constructed. The Hon'ble Supreme Court in a catena of cases has also emphasised the importance of sustainable development and allowed projects to continue where environmental considerations and impacts, including mitigation measures, are duly accounted for. The same shall be relied upon during the course of the arguments.

38. That in response to the contents in para 12-14, the contents of the preliminary submissions are being reiterated and are not being repeated for the sake of brevity.

39. That in response to the contents in para 15-19, the contents of the preliminary submission vis a vis the absence of turtle nesting sites are being reiterated and are not being repeated for the sake of brevity. The Appellant is put to strict proof with respect to the alleged turtle nesting period, which has been claimed without any reliance on scientific paper or study. Further, ZSI in its report has clearly stated that sporadic nesting occurs however, the same is not feasible

on the site of the Soda Ash Plant due to presence of steep slope of sand dunes, high tide water touching sand dune bottoms, beach rocks as well as numerous predators. However, the Appellants have challenged the said findings based on RTI response from the Forest Department, wherein the figures in themselves prove that the nesting in the entire Mandvi region is sporadic as one turtle in a single nest lays about 100-200 eggs. Thus, clearly the site of the answering Respondent is not a major turtle nesting site.

40. That the contents of para 20- 45 are a repetition of the submissions of the Appellant in the Appeal as well as the preliminary submissions of the Rejoinder. The submissions of the answering Respondent in the abovementioned preliminary submissions may be read as a response to the said paragraphs and is not being repeated for the sake of brevity.

41. That it is pertinent to mention that the soda ash project construction has not been commenced yet by the Respondent No. 4 as the work with respect to acquisition of land and demarcation of the boundary is still ongoing. However, the Respondent No. 4 has already commenced implementing activities with reference to vocational and technical training of the members of the village community, generating employment opportunities, and increasing health care facilities as part of its Corporate Social Responsibility. The detailed presentation of the CSR activities along with the photographs are marked and annexed as **ANNEXURE R/18 (Colly)**.

42. That for all the reasons set out above, in the alternative and without prejudice to one another, and other oral submissions to be advanced and judgments to be referred to and relied upon by the Answering Respondent at the time of arguments, the Answering Respondent most respectfully submits and prays that the present Appeal, which is a gross abuse of the process of law, deserves to be dismissed *in limini* by this Hon'ble Tribunal with exemplary costs as any

further delay would cause irreparable prejudice and hardship to the Answering Respondent which is setting up the Soda Ash Project at a huge cost of Rs.7,000 Crores with the fond hope that its Soda Ash Project would amongst other factors: (a) help generate huge employment opportunities both, direct and indirect, (b) Implementation of Wild Life Conservation Plan and other bio diversity improvement projects by the Answering Respondent to improve bio diversity of the regions. (c) help generate substantial revenue to the Central and State Exchequer in the form of direct and indirect taxes and (d) help bridge the demand supply gap present in the soda ash industry, all of which will cumulatively contribute to the growth and wealth of the Nation.

Place: Pune

Date: 25.06.2025

DRAWN & FILED BY:

Mbachani

Mansi Bachani & Gitanjali Sanyal
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SETTLED BY:

Mr. Sanjay Upadhyay
[Senior Advocate]

**IN THE HON'BLE NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE
APPEAL NO. 19 OF 2025**

IN THE MATTER OF:

Vijaykumar Karsanbhai Gadhavi

...Applicant

-Versus-

Union of India & Ors.

...Respondent (s)

AFFIDAVIT

I, Ranjan Tiwari S/o Late Shri H.C. Tiwari aged about 55 am the Authorized Signatory for GHCL Ltd., B-38, Institutional Area, Sector - 01 Noida, Uttar Pradesh - 201301, presently at New Delhi, do hereby solemnly affirms and declares as under:

4. That I am fully conversant of the facts and circumstances of the matter and am competent to swear this affidavit.
5. The contents of the accompanying Sur-Rejoinder are true and correct to the best of my knowledge and have been drafted by the counsel on my instructions and nothing material has been concealed therefrom.
6. That the Annexures in the accompanying Sur-Rejoinder are true and correct to the best of my knowledge.

Ranjan Tiwari
D/5607/2019
I identify
has sig.

For GHCL LIMITED
Ranjan Tiwari
DEPONENT

VERIFICATION:

25 JUN 2025

Verified at New Delhi on this.....day of....., 2025 that the contents of the above affidavit are true and correct to my knowledge and belief and nothing material has been concealed therefrom.



ATTESTED

Neelam Sharma
NOTARY (Govt. of India)
Neelam Sharma, Advocate
Enrol. No. D/381/2001
Ch. No. 165A Gate No. 11
Patiala House Courts,
New Delhi-110001
(M): 9898408301

For GHCL LIMITED
Ranjan Tiwari
DEPONENT

25 JUN 2025

NCSCM Map CVCA Demarcation

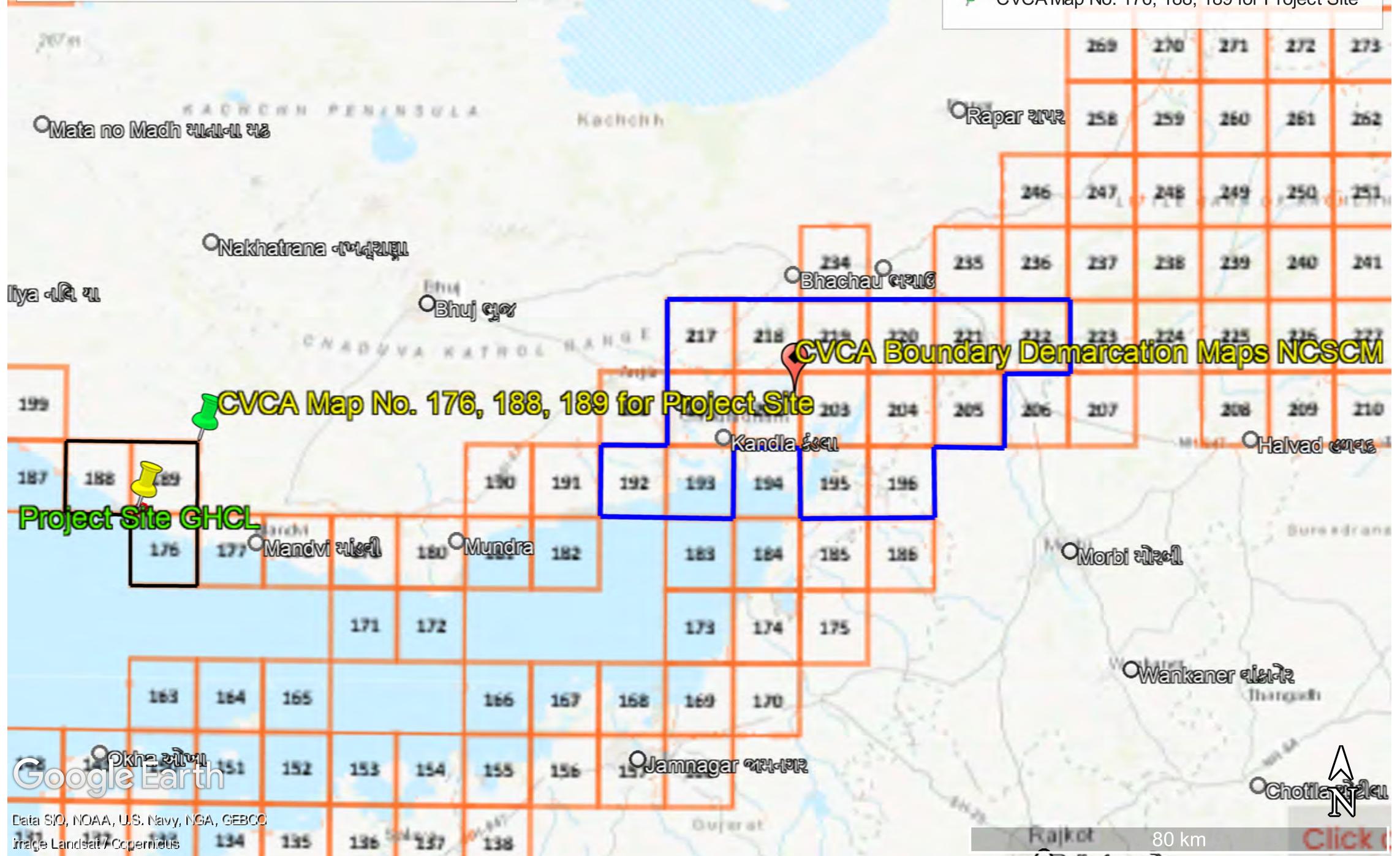
27 Dholavira ધોળાવીરા

ANNEXURE R/1

3577

Legend

- CVCA Boundary Demarcation Maps NCSCM
- CVCA Map No. 176, 188, 189 for Project Site



CVCA Boundary Demarcation Maps NCSCM

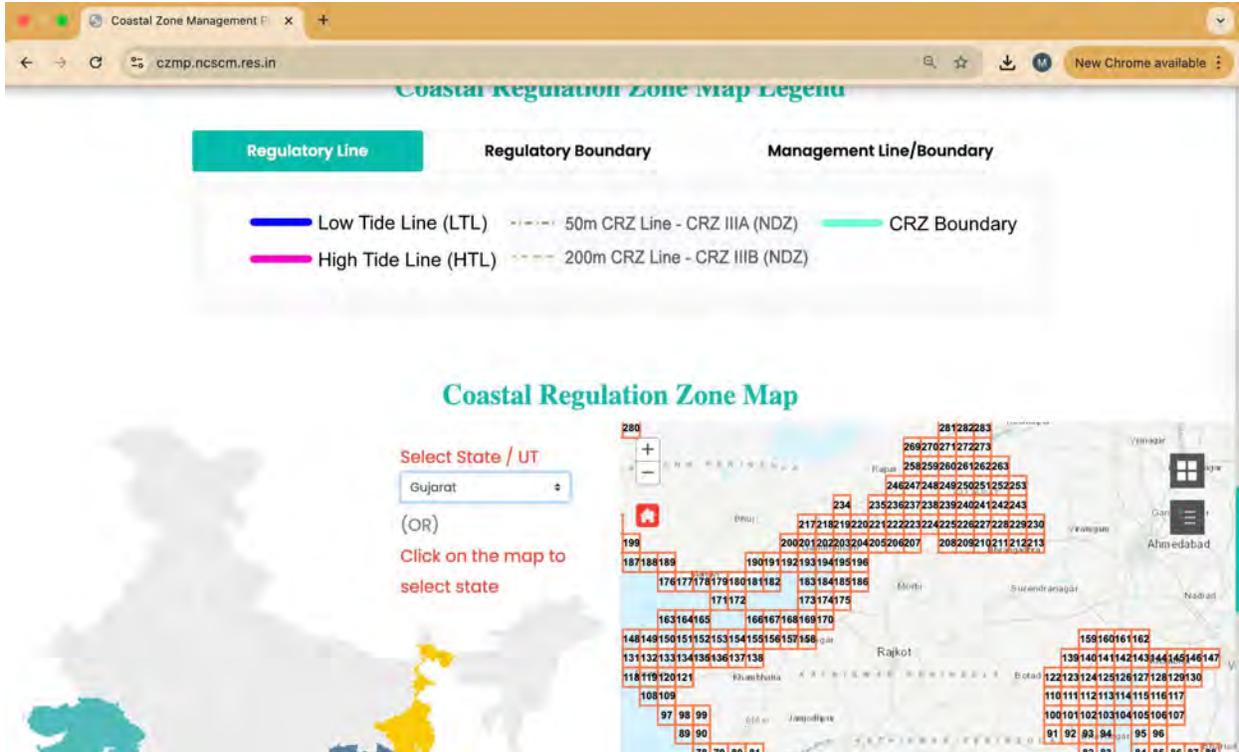
CVCA Map No. 176, 188, 189 for Project Site

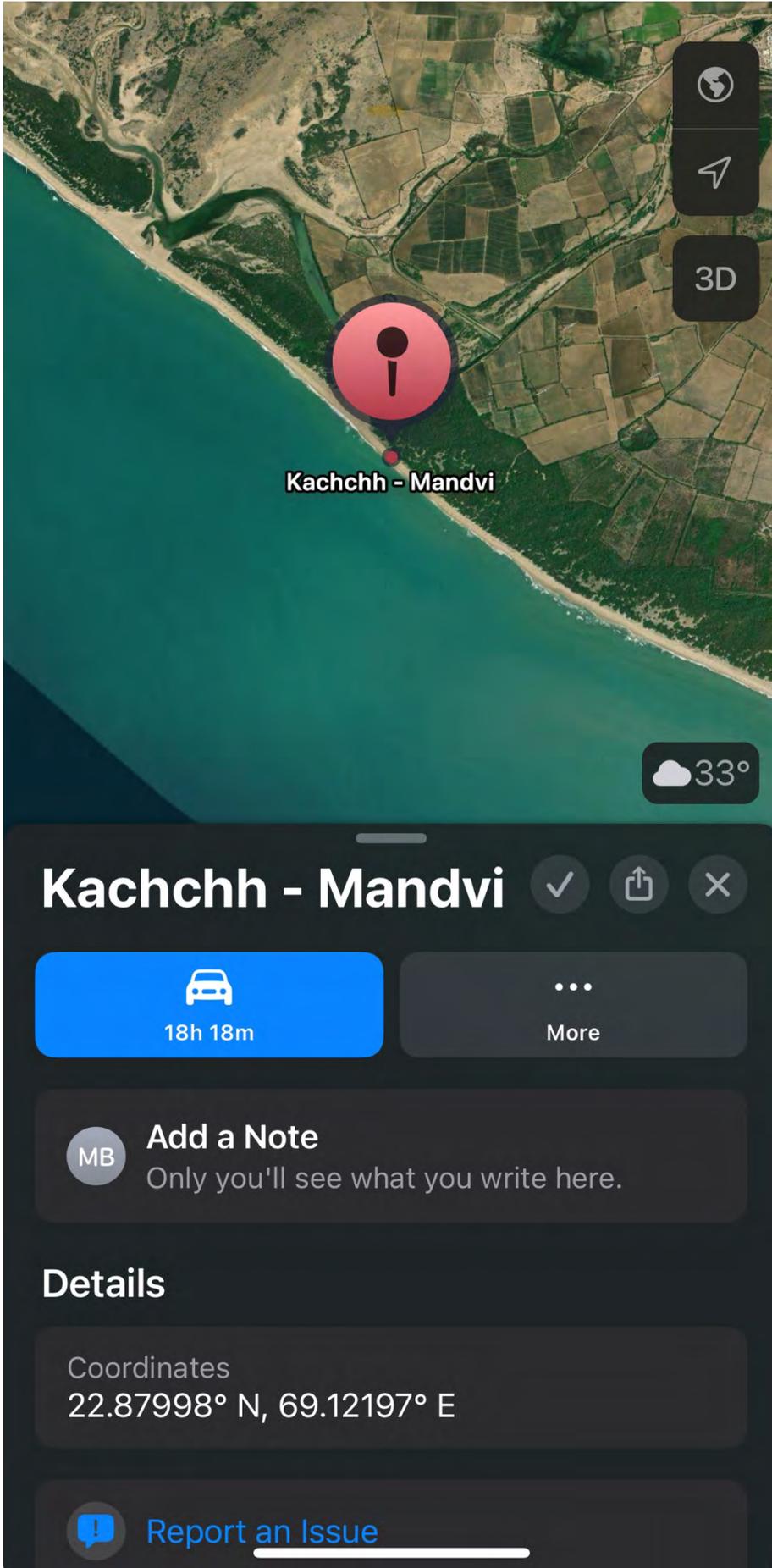
Project Site GHCL

Google Earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat/Copernicus

80 km





















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HOW MANY EGGS DOES A SEA TURTLE LAY?

[Home](#) » [Sea Turtles FAQ](#) » **How many eggs does a sea turtle lay?**

Last Updated: March 14, 2025

How Many Eggs Does A Sea Turtle Lay?



Nesting Green Sea Turtle
Olive Ridley Project • अनुसरण करा

शेअर करा

The number of eggs in a nest, called a clutch, varies by species. On average, [sea turtles](#) lay 110 eggs in a nest, averaging between 2 to 8 nests a season. The smallest clutches are laid by Flatback turtles, approximately 50 eggs per clutch. The largest clutches are laid by [hawksbills](#), which may lay over 200

In the Maldives predominantly [green](#) and hawksbill turtles are nesting. On average green turtles lay a mean of 110 eggs per nest with the largest clutches ever recorded of up to 238 eggs! Our own studies show clutch size to be 77-124 eggs with the largest clutch recorded at 205 eggs.

Mean clutch size for hawksbills is significantly larger than that with around 150 eggs per nest in the Caribbean, variation is roughly the same with 86-206 eggs per nest. In the Indian Ocean data from the Seychelles shows even higher mean clutch size with 182 eggs per nest (160-242 range). The largest clutch recorded by the ORP on Félicité Island was 217 eggs!

Learn More About Sea Turtles – Free Online Courses



E-Turtle School – All About Sea Turtles

Everything you have ever wanted to know about sea turtles, from evolution to conservation. Suitable for all sea turtles lovers and those who want to learn more about these fascinating creatures.

[Learn More](#)



Sea Turtle Science & Conservation

Deep dive into sea turtle science and conservation. Suitable for budding conservationists and those with an interest in the science surrounding turtles, their biology and conservation.

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- *Diamond AW 1976. Breeding Biology and Conservation of Hawksbill Turtles, Eretmochelys imbricata L., on Cousin Island, Seychelles. Biological Conservation 9:199-215. (Hughes 1974b)*

[Back to Top](#)



**STATUS SURVEY AND SITE-SPECIFIC CONSERVATION PLAN FOR SEA
TURTLES FOR PROPOSED GREENFIELD CHEMICAL COMPLEX NEAR VILLAGE
BADA, TALUKA - MANDVI, DISTRICT - KACHCHH, GUJARAT**

Submitted to



M/s. GHCL Limited

Submitted by



**Gujarat Institute of Desert Ecology (GUIDE)
Opp. Changleshwer Temple
Mundra Road, Bhuj-370 001
Kachchh, Gujarat**

January 2023

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Dr Nikunj B. Gajera, Scientist**Team Members**

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3	Mr. Viral Vadodariya	Project Fellow
4	Mr. Karan Thakkar	Project Fellow
5	Mr. Masud Badi	Project Assistant

Table of Contents

S.No.	Contents	Page No
1.0	Introduction	1-2
1.1.1	Evolution and Biology of Sea Turtles	2-3
1.1.2	Life history of sea turtles	3
1.1.3	<i>Reproduction</i>	3
1.1.4	<i>Nesting</i>	3
1.1.5	<i>Philopatry</i>	4
1.1.6	<i>Nest site fidelity</i>	4
1.1.7	<i>Emergence of hatchlings</i>	4
1.1.8	Sea turtle distribution, major nesting and breeding centre in India	5-6
1.1.9	Sea turtle distribution in Gujarat	6-7
1.1.10	Genesis of the Project	7-9
1.1.11	Objectives	10
2.0	Background and Literature Review	11-12
3.0	Study Area	13-16
3.1.1	Study Duration	17
3.1.2	Coastal and Beach Characteristic Feature of The Study Area	17-21
4.0	Methodology	22
4.1.1	Desk Study (Macro level approach)	22
4.1.2	Preliminary Field Survey	22
4.1.3	Sea Turtle Nesting Survey	22
4.1.4	Survey techniques	23
5.0	Observations and Results	24-30
5.1.1	Field signs of a nesting crawl	31
6.0	Sea Turtle Conservation Efforts	32
6.1.1	Conclusions	33
6.1.2	Recommendations	34-35
7.0	Site Specific Conservation Plan for Sea Turtles	36-40
7.1.1	Nesting biology	37
8.0	References	41-43

1.0. INTRODUCTION

Sea turtles, aptly termed as living fossils, due to its long evolutionary and geologic history. Thus, Sea turtles represent an ancient and distinctive part of the world's biological diversity. Sea Turtle is a large reptile that has a thick shell covering its body and lives in the sea most of the time, coming ashore annually on sandy beaches to lay eggs. Sea turtles have played vital roles in maintaining the health of the world's oceans for more than several million years. These roles range from maintaining productive coral reef ecosystems to transporting essential nutrients from the oceans to beaches and coastal dunes.

There are seven known species of sea turtles that inhabit in the world's oceans; the Leatherback, Green, Olive ridley, Hawksbill, Loggerhead, Kemp's ridley and Flatback turtles. Out of the total seven species, former five species of sea turtles inhabit the Indian water for feeding and breeding purposes (M. Rajagopalan, 1997). All the five species of sea turtles are endangered and under the Schedule I of the Wild Life (Protection) Act 1972.

Sea turtles have remarkable life cycles which makes them fascinating to both biologists and wildlife enthusiasts. They are found in all major ocean basins, and typically inhabit tropical and subtropical waters, although individuals are known to have been found in the colder waters of the Arctic (Sea turtles of India, 2011) regions.

Once they leave the breeding beach as hatchlings, only females will return to land during the nesting period while male sea turtles generally never return to land, except in some instances where they have been known to bask. Consequently, most research has been confined to that brief period in their life cycle when they do come ashore. Most sea turtles undertake long distance migrations, as hatchlings and juveniles, during a long pelagic phase in the open ocean sea, and as adults between their feeding and breeding grounds (Sea turtles of India, 2011). Loggerheads migrate over 12,000 km across the Pacific from their feeding habitats in Baja California to their nesting grounds in Japan. Green turtles migrate from their feeding grounds in Brazil to nest on Ascension Island, a speck in the middle of the Atlantic Ocean (Sea turtles of India 2011). On the east coast

families of sea turtles are believed to have existed, of which two families survived into the current era: Dermochelyidae and Cheloniidae.

1.1.2 Life History of Sea Turtles

1.1.3 Reproduction

Males and females begin the reproductive cycle by migrating from their feeding grounds to breeding grounds. Feeding and breeding grounds may be separated by several thousands of kilometers. Courtship and mating occur primarily in the offshore waters of the breeding ground; the male mounts the female, holding her with claws in his fore flipper and proceeds to mate. Both males and females may mate with several different individuals.

1.1.4 Nesting

Several weeks after mating, the females come to shore for nesting, mostly during the night periods. They crawl above the high-water mark, find a suitable nesting site, clear away the surface sand (making a body pit), and dig out a flask shaped nest with their hind flippers. This may be two to three feet deep depending on the size of the turtle. They lay about 100 – 150 eggs in the nest and fill it with sand; some species thump the nest with their body to compact the nest. Once the turtle starts laying eggs, they go into a 'nesting trance' and are less easily disturbed during this stage. They then throw sand around the nest to camouflage it and return to the sea. Beach selection is affected by accessibility of the beach as well as height and substrate. Different turtles prefer different types of beaches to nest. For example, Olive ridleys and Leatherbacks prefer wide beaches and sand bars at river mouths, while Hawksbills and Green turtles prefer small island beaches. Most turtles nest more than once during a season, with roughly two weeks separating each nesting event. After they have completed nesting, they return to their feeding grounds until the next breeding migration, which may be a year or years later.

7. Bhavnagar	152	100.75	7	0.07
8. Ahmedabad		No potential nesting habitat		
9. Kheda /10 Anand		No potential nesting habitat		
11. Bharuch		No potential nesting habitat		
12. Surat		No potential nesting habitat		
13. Valsad*	90	28.50	21*	0.23*
Overall Total	1313	519.75	676	1.38

*Very old nesting locations. Source: Sunderraj *et al.*, 2002

1.1.10. Genesis of the Project

GHCL Limited is one of the leading manufacturers of Soda Ash (Anhydrous Sodium Carbonate) in the country. GHCL has signed an Memorandum of Understanding with Govt. of Gujarat during the Vibrant Gujarat Summit in 2017 for the establishment of Greenfield Chemical Complex in Kachchh District. Thus, in order to create new Greenfield capacity for Soda ash and to meet growing demand from user industry and to honour the commitment made during Vibrant Gujarat Summit, it is proposed to set up Greenfield Chemical Complex in District Kachchh. The Greenfield Chemical Complex comprise of manufacturing units for Soda Ash (Light and dense), Sodium Bicarbonate, Captive Power plant and Seawater Intake and Effluent Disposal System. Project site has been identified near the coastal stretch along Arabian Sea Coast near village Bada, about 30 km from Mandvi (approx. stretch 22 52 25.38 N, 69 8 21.15" E - 22 52' 57.10 N, 69 7'33.09" E).

The proposed project is majorly Soda Ash production which is different from the present establishments along the Kachchh coast like Ports, SEZ, Petroleum and petrochemical complexes, ultra-mega power plants, cement industry, salt works, mining etc. Any significant marine traffic is not expected from the project which can lead to increase in existing vessel traffic in the Gulf. M/s GHCL Ltd. was established in 1983. The company is mainly in business of Soda Ash and Sodium Bi-carbonate manufacturing. The manufacturing plants are located at Sutrapada, District Gir-Somanth in the State of Gujarat, India. It contributes to almost 25% to 29% of the annual domestic demand of the country. Soda Ash product is having significance because of its use in major consumption related sectors like chemicals, detergents, water treatment, glass manufacturing, pulp and paper, textile and mining industry etc. Sodium Bicarbonate is widely used in Food

industry. As there is no sustainable water resources present in the vicinity except Arabian Sea, thus, it is proposed to withdraw seawater from Arabian Sea off Bada coast. At present all major Soda Ash Plants in India are located along the sea coast.

MoEF & CC had granted ToR for the project in August, 2021. GHCL had engaged CSIR-NEERI and CSIR-NIO for the preparation of EIA reports w.r.t Terrestrial and Marine environment. Company has also engaged CSIR-NIO Goa unit for carrying out the study on Sand Dune morphology while Wildlife and ecology related studies had been carried out by a NABET accredited Functional Area Expert. In 2019, the Zoological Survey of India (ZSI) has done the site-specific study on sea turtle for the GHCL. The proponent GHCL Ltd. applications for securing environment, forest and CRZ clearance are under scrutiny level at MOEF & CC and Gujarat State Coastal Zone Management Authority. There are some literature's available on the sporadic nesting of Sea Turtles along the sandy coast of Mandvi region which requires to prepare conservation plan for the area under project influence. Therefore, GHCL has consulted Gujarat Institute of Desert Ecology (GUIDE), Bhuj for carrying out study "Status Survey and Site-specific Conservation Plan for Sea Turtles".

The proposed chemical complex will be set up landwards to the existing sand dune stretch. The sand dune and shore area will be used for laying seawater intake and effluent disposal pipelines. The pipelines have to be laid through sand dune stretch as there is no natural passage available in this area. For protection of sand dunes, the pipeline will be laid through underground tunnelling. The laying of seawater intake and effluent disposal pipelines is a one-time activity and the activity will be restricted up to construction phase only. As the pipelines are part of utility infrastructure for the proposed project no significant source of illumination is separately required for them. GHCL ltd. had applied for diversion of forest land required for laying seawater intake and treated effluent disposal pipelines.

The Soda Ash manufacturing along with Captive Co generation power plant requires large quantity of water for cooling process. In the absence of any other

sustainable source of water in the project area it is proposed to withdraw required quantity of water from nearby Arabian Sea coast off Bada through an efficient seawater intake system. The combine effluent generated from various streams of plant like process and utilities, etc. after mixing/diluting with return once through cooling water/fresh seawater will be released to a recommended location off Bada coast (EIA studies, NIO Mumbai) through a pipeline and diffuser system in order to achieve effective dilution and dispersion. The released effluent will meet the discharge standards notified for Soda Ash Industry.

Accordingly, a proposal and scope of the study was sent to M/s. GHCL and to undertake the field studies on Sea Turtles in the project location within 10 km radius and on the basis of the proposal submitted by GUIDE to M/s. GHCL, a Work Order (No. 4530003859) was released by M/s. GHCL for carrying out detailed study on "Status Survey and Site-specific Conservation Plan for Sea Turtles for proposed Greenfield Chemical Complex at village Bada, Taluka - Mandvi, district - Kachchh, Gujarat" at the project location.

The above study was carried out in the proposed Greenfield Chemical Complex Project location of M/s. GHCL, LTD along the Arabian Sea Coast near village Bada located in the Kachchh district of Gujarat on the Status Survey and Site-specific Conservation Plan for Sea Turtles and suggest Site Specific Conservation Plan and company's approach to protect and support conservation of wildlife around the project as per below objectives:

1.1.11. Objectives

1. Identify and assess the status of different sea turtle Species in the study area.
2. Identify and evaluate the status of breeding/nesting ground of sea turtle in the study area.
3. Suggest mitigation measures to minimize the identified impacts on the project components
4. Prepare the Site-specific Conservation Plan of Sea turtle species for the proposed project.

2.0. BACKGROUND AND LITERATURE REVIEW

The state of Gujarat on the west coast of India has 92 species of reptiles from 63 genera belonging to 20 families (Vyas, 1998), which includes four species of sea turtles, namely Olive ridley, Green, Leatherback and Hawksbill turtles. However, nesting of only olive ridley and green turtles has been documented on the Gujarat coast (Bhaskar, 1978 and 1984; Kar and Bhaskar, 1982), while the other two species are occasionally sighted by local fishermen. Though sea turtle research activities started in late 1970's in Gujarat coast, most of them were short term and rapid surveys. Frazier (1980) has discussed the threats to the sea turtles of Gujarat in terms of eggs and animal poaching, and there is information on an international tag record (Firdous, 1991) and a necropsy of a stranded animal (Frazier, 1989). Except for these notes and a few sketchy and old survey reports, there is no other information on these nesting populations and potential nesting habitats. Based on one time survey by Sunderraj *et al.*, (2002) discussed nesting density, egg predation and provided qualitative information on threats like mining and beach contamination due to spread of oil particles and sea garbage. However, very limited long-term data is available on Green sea turtles for Mandvi coast, though the Gujarat coast supports the only significant nesting of green turtles along the coast of India.

However, in the Kachchh region the sandy beach of Suthri (22°57.305 - 69°00.121) coast is identified as turtle nesting habitat based on the assessment of the Conservation Priority Index (CPI) with a value of 0.53 and is categorized as a candidate site for conservation (Saravanan *et al.*, 2013) which is located significantly away from present study area.

Later, in 2019 the Zoological Survey of India (ZSI) has carried out the site-specific study from September 2018 to March 2019 "Status Survey and Conservation Plan for Sea Turtle" for the GHCL and did not encounter any sea turtle and fresh/old nests or crawl marks of turtles on the beach. Nevertheless, between Mandvi and Pingleshwar is sandy coast and this stretch attracts Sea Turtle for visiting these areas during the breeding seasons (ZSI, 2019).

There are few studies which have discussed the direct and indirect threats to sea turtles and their habitats in India. Nest predation by animals and local people for consumption of eggs is a common threat to sea turtles along the Indian coast (Frazier, 1980; Kar and Bhaskar, 1982; Bhaskar, 1984, 1993; Rajagopalan *et al.*, 1996; Pandav *et al.*, 1998). Incidental catch in fishing gear like trawl and gill net has been reported as the major threat in different coastal districts (Rajagopalan *et al.*, 1996; Pandav and Choudhary, 1999; Pandav *et al.*, 1997; Pandav 2001; Tripathy *et al.*, 2003). Coastal plantations (Pandav *et al.*, 1998) and sand mining along the nesting beaches have been documented as major threats to turtle habitat (Bhaskar, 1984 and Andrews, 2000). All these threats have been reported along the Gujarat coast (Bhaskar, 1984; Sunderraj *et al.*, 2002). However, the magnitudes of their impacts need to be studied with long term monitoring programmes.

3.0. STUDY AREA

Gujarat state is situated along the North-western frontier of India, coast is endowed with two Gulfs in which Gulf of Kachchh is the largest inlet of the Arabian Sea.

Kachchh district derived its name from *Kachhuba* (Turtle) due to its Geographical Characteristics; turtle-like shape. The district lies 78 °.89' to 71 °.45' E longitude and 22 °.44' to 24 °.41' N latitude. The district encompasses a total area of 45,652 km² and is poorly endowed in terms of its land quality, as about 23,310 km² (51%) area is covered by saline deserts (Greater and Little Ranns). The coastal area of Kachchh district consisting of Lakhpat, Abdasa, Mandvi, Mundra, Anjar, Gandhidham and Bhachau talukas which lies along the southern and north-western part of the district.

The district falls under arid tract which faces serious climate related problems like; low annual rainfall (326 mm), high rates of evaporation, less surface water availability for irrigation, alarming fall of ground water table and quality and increasing salinity.

The present study area in the Kachchh district is located along the Gulf of Kachchh which is situated in the northern Arabian Sea. The Gulf of Kachchh is 140 km in length, and 70 km wide near the mouth and gets narrowed at the head of the embayment. It is a macro-tidal environment with tidal ranges between 3 m at the mouth to about 5 m at the head. There are number of ports, jetties and industrial developments all along the coastal areas of the Gulf of Kachchh.

The Kachchh mainland, which bounds the northern side of Gulf of Kachchh, has several southward flowing seasonal rivers and streams such as Naira, Kankawati, Chok, Sai, Vengdi, Kharod, Rukmawati, Khari, Nagavanti, Phot, Bhuki, Mitti, Sakra and Larekh empty their water into the Gulf of Kachchh and the Arabian Sea.

The present study area has confined to the northern coast of the Gulf of Kachchh, near to coastal villages Modkuba to Nana Layja of the Mandvi taluka of the Kachchh district.

The few villages near to coast of the Mandvi taluka falls under the study area;

Modkuba coastal village is also a gram panchayat. The village encompasses an area of 1200.62 ha that supports 132 households and a total population of 562 peoples (Census 2011).

Bambhadai village has an area of 3582.12 ha, that supports 151 households and a total population of 382 peoples.

Bada village has an area of 3725.45 ha, that supports 592 households and a total population of 2,719 peoples.

Panchatiya village has an area of 1133.09 ha, that supports 155 households and a total population of 711 peoples.

Bhada village has an area of 616.18 ha, that supports 187 households and a total population of 802 peoples.

Layja Nana village has an area of 1002.8 ha, that supports 197 households and a total population of 960 peoples (Census 2011).

The above villages hold very meagre human population (382 to 960 individuals), however, Bada is the largest village (3725ha) and more populated village (2719 individuals) when compared to other villages.

Proposed Industrial Development by GHCL

The proposed site is recognised to set up a green field chemical complex with Soda Ash, Sodium bi carbonate manufacturing plant supported by utilities like solid fuel based captive co-generation power plant, sea water intake and effluent disposal system, RO system and associated infrastructure near village Bada, taluka Mandvi, District Kachchh, Gujarat. The identified site is located near the stable coast off Bada stretch near Mandvi (Figure 1).

The core area proposed for establishment of the project plant (Figure 1) covers around 547 ha (1350 acres) of both private unirrigated agriculture land and Government owned land (Sarkarshree land), near the Bada village of Mandvi

Taluka in Kachchh district of the state of Gujarat. The proposed land area is having sparse vegetation dominated by *Prosopis juliflora* and other thorny scrubs. There were no major streams and drainage within the proposed area. The Soda Ash process along with captive co-generation power plant in totally requires huge quantity of cooling water. The sea water requirement for process cooling, RO/DM plant, utilities and process plant effluent dilution etc., would be met by draining seawater from the Arabian Sea Coast in proximity to the project location.

The Arabian Sea coast is located south of the proposed boundary of the project. The area is located at 6.0 km distance from the National Highway NH-41. The project site does not fall in 10.0 km periphery of any National Park or Sanctuary or eco-sensitive zones.

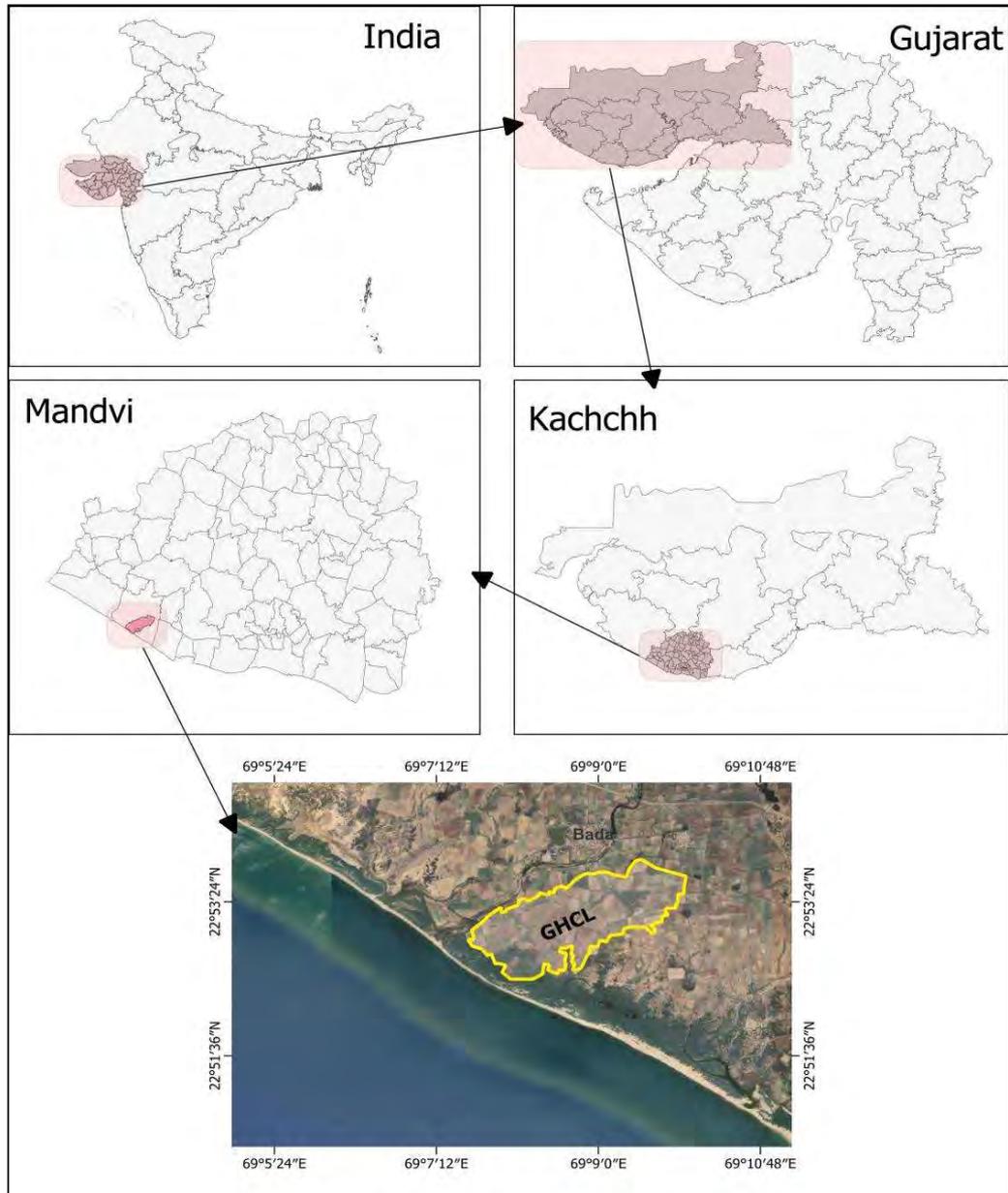


Figure 1: Proposed Project Location Near Bada Village of Mandvi Taluka of Kachchh District in Gujarat

3.1.1. Study Duration

The Olive ridley turtle reported to nest between June and early November on the Gujarat coast while green turtle nesting takes place between July and ends in January. However, sporadic nesting takes place throughout the year along the Gujarat coast (Sundarraaj *et al.* 2013). Therefore, surveys were carried out from June 2022 to January 2023, so that sea turtle nesting activities during the peak breeding seasons, if any in the study area could be documented effectively.

The coastal stretch from Nana Layja (Aashar Mataji Temple) to Modkuba beach was surveyed on foot by the survey team consisting of Scientists and field personnel from GUIDE for the purpose of recording any nesting/crawl marks of turtles along the coastal stretch including stretches along which the project is proposed. Along with that, the team also made an assessment of the coastal and marine habitat along with overall biodiversity of the site in line with the objectives.

3.1.2. Coastal and Beach Characteristic Feature of The Study Area

The coast at Nana Layja (Aashar Mataji Temple) to Modkuba coast segment has almost continuous occurrence of sandy beaches and back-shore dunes, except at Naira River mouths. The beach ridges are 3-5m high with a steeper (~15°) seaward slope. The presence of stabilized and active coastal dunes is marked all along the coast behind the beach ridges. Overall, the intertidal zone is steeper and narrow however, also has some broad intertidal zone areas. Many seasonal rivers and streams flow in this segment, river Sai and Vengadi is important. The beach profile feature like, tidal variations, height of dune, geomorphology, beach width, inundation risk, etc. were considered on site while understanding the surveyed beaches for their suitability with reference to turtle nesting.

This coastal segment between Nana Layja and Mandvi has a presence of features like 20-50 m wide beaches, about 50-200 m wide coastal dunes and a number of coastal streams. The coastline is composed of minor cuspets along the seaward margin of the beach, beach cusps of 30 to 70 m average length along the berm outline and sand waves of 500-700 m length, which includes all the minor

6.1.1. CONCLUSIONS

The coastal area of the country and along the Gujarat coast is subject to natural and anthropogenic pressures. Coastal Vulnerability Index (CVI) values categorized for the Gujarat coast into four risk level classes, in which 785 km (45.67 %) of the Gujarat coast is under high to very high-risk category due to an anticipated rise in sea level. The coastal regions under very high-risk category are along north-western parts of the Gulf of Khambhat, the northernmost parts of the Gulf of Kachchh and western parts of the Kachchh coast (M. Mahapatra, 2015). As per R. S. Kankara *et al.*, (2018) the Kachchh coast experiences all three categories; i.e., erosion (92.72km), accretion (124.26km) while stable coast covers 169.66km out of the total coastal length of 386.64km. As per SAC (2021), along the northern coast of the Gulf of Kachchh erosions are observed to the south of Rukmavati River (41F05SW), near Mandvi (41F05SW), north of Kharod River (41F01SE). The coastal areas of Panchatiya, Bhada and Mandvi experiences erosion and accretion at some places and with changes in the hightide line when compared from 2004-06 to 2014-16 while Bambhadai coastal belt has changes in the high-tide lines (SAC, 2021). Krunal Patel *et al.*, (2022) reported through a multi-temporal Landsat digital data over the period from 1978 to 2020 highlighted that the highest coastal erosion took place in the Kachchh district. High coastal erosion was observed in 62.3km length, moderate to 115.60km and low erosion was recorded in 132.70km stretch, totalling to 310.60 km stretch facing various degree of erosion problems.

The problems associated with coastal erosion, accretion and changes in high tide line has led to loss or submergence of certain coastal areas and changes in the availability of suitable nesting locations in the study area during the recent past. Sea turtles prefer nesting location which are sandy and exposed to sunlight for hatching success. In general, all sea turtle species tend to nest above the high-water mark to reduce the risk of tidal inundation or egg wash out (Fowler, 1979 and Mortimer, 1982). The above natural causes would have some influence on the availability of suitable nesting locations that prevented the turtles to find suitable locations along the coast. Therefore, our observations suggests that the coast near the proposed project site may not be appropriate for sea turtle

nesting due to inundation risk due to narrow supra tidal region, significant dune height, unfavourable slope features, dense vegetation and presence of predators like dogs, jackals etc. This could be the reason; no direct or indirect evidences of sea turtle nesting was observed from the study area during the eight months monitoring from June, 2022 to January 2023.

However, previous records/study indicates that the coastline of Mandvi about 25 km from proposed site is important for sea turtle nesting habitat in Kachchh. Based on the detailed field survey and monitoring of sea turtle nesting, due to its narrow width, the proposed GHCL site beach gets inundated during high tide and thereby not favourable for sea turtles for laying eggs. It was observed that due to its narrow beach width, vegetation cover, slope, presence of pebbles and rubbles and presence of predators on the beach are the reasons that the sea turtles may not favouring this area for nesting purposes. However, the stretch between Nana Lyja (Asar mata) and Modkuba (about 5.0 km from proposed project site) and Mandvi palace (about 25 km from project site) is sandy, vegetation to high tide line is wide and much of the sporadic nesting could be taking place along this coastal stretch and Chacchi to Suthri is highly significant for probable sea turtle nesting. In Kachchh district, the coastal beach at Suthri was recommended as important beach to be managed for sea turtle nesting by the Wildlife Institute of India (Saravanan *et al.*, 2013)

6.1.2. Recommendations

Nesting beach surveys were widely used for monitoring sea turtle populations. Surveys may be conducted on a single day (a 'snapshot' of a nesting beach) or may be intensive, long-term structured monitoring of sites during the whole nesting season. Since methodologies vary widely, it is often difficult to compare surveys conducted at different sites, or even surveys of the same site carried out by different methods at different points of time. Hence, it is of utmost importance to use a standardized method that is repeatable and comparable. Nesting surveys often begin with beach assessments, which identify potential nesting sites, seasons and the species using the area for nesting. Often, preliminary beach

surveys can be combined with primary nesting assessments, as long as the survey is carried out during the nesting season (Shanker *et al.* 2010).

Educating the fisherfolk and coastal residents regarding the conservation of sea turtles can help to reduce egg poaching, sewage pollution, sand mining, and recovery of turtles in their fishing nests. Coastal industrial sectors can help through sustainable plans for further expansions and developments along the coast and also reduce coastal pollution. Further can provide infrastructural and financial support for research and sea turtle conservation.

- GHCL to carry out laying of pipeline / tunneling work in consultation with geo-technical experts and use proven construction methodologies for such terrains, so that the disturbance on the habitats will be minimized . Therefore, it is mandatory to select the adaptive methodology and agency considering their experience for carrying out such work.
- It is recommended to draw an activity schedule chart and adhere to timelines as any overrun of construction duration may lead to impact the near shore area. GHCL to restore the near shore habitat once the construction activity gets completed.

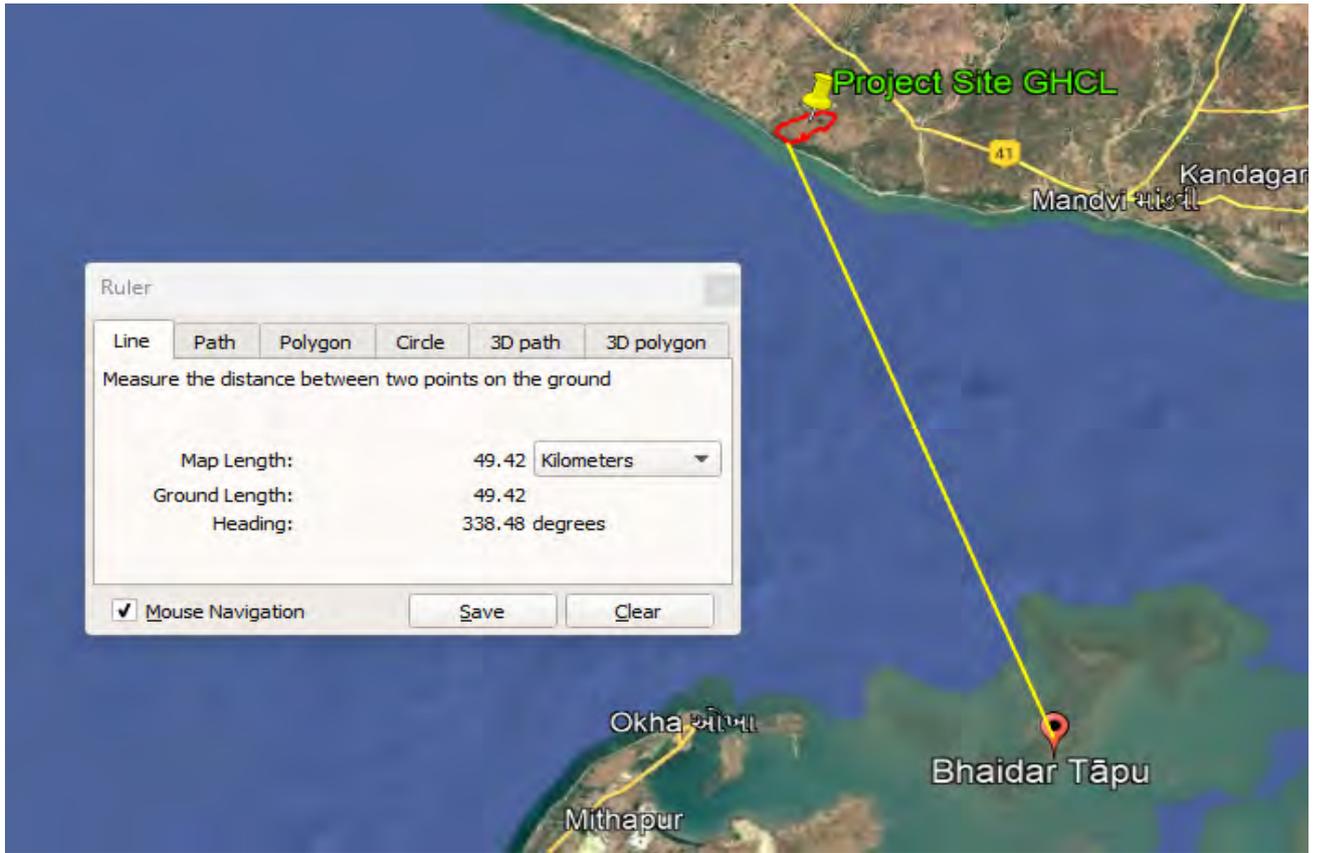
GHCL to select efficient process technology and implement an effective environment monitoring programme to keep the released effluent within standards specified for Soda Ash Industry, which is to be monitored by marine monitoring agency periodically to asses the ambient sea water quality near effluent discharge locations.

- It is recommended to maintain the cleanliness of the shore area and create awareness and conduct beach clean up programmes.
- Further, GHCL to put marker buoys at seawater intake and effluent disposal locations for navigational aids.
- It is recommended to make awareness programmes for contractors and workmen regarding conservation of sea turtles.

GHCL to inform / report to the local Forest Dept. in the event of any sighting of sea turtles near the project coast.

- Mounting of lighting fixtures as low as reasonably possible in order to minimize lighting effect towards shore which should not affect sea turtle during the nesting season.
- Overall, GHCL to obtain necessary EC-CRZ approval from MOEFCC prior to conduct of any activities to the project location.

ANNEXURE R/6



No.IA-J-11011/293/2021-IA-II(I)

ANNEXURE R/7

Government of India
Minister of Environment, Forest and Climate Change
Impact Assessment Division

Indira Paryavaran Bhavan,
Vayu Wing, 3rd Floor, Aliganj,
Jor Bagh Road, New Delhi-110003
10 Aug 2021

To,

M/s GHCL LIMITED
GHCL HOUSE, OPPOSITE PUNJABI HALL, NAVRANGPURA, AHMEDABAD,
Ahmedabad-380009
Gujarat

Tel.No.079-26434100; Email:projectsodaash@gmail.com

Sir/Madam,

This has reference to the proposal submitted in the Ministry of Environment, Forest and Climate Change to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format (Form-1) along with a Pre-feasibility Report. The details of the proposal are given below:

- | | |
|---|-----------------------------|
| 1. Proposal No.: | IA/GJ/IND3/222096/2021 |
| 2. Name of the Proposal: | Greenfield Chemical Complex |
| 3. Category of the Proposal: | Industrial Projects - 3 |
| 4. Project/Activity applied for: | 4(e) Soda ash Industry |
| 5. Date of submission for TOR: | 06 Aug 2021 |

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard TOR for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance is prescribed with public consultation as follows:

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

4(e): STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR SODA ASH PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT

A. STANDARD TERMS OF REFERENCE

1) Executive Summary

2) Introduction

- i. Details of the EIA Consultant including NABET accreditation
- ii. Information about the project proponent
- iii. Importance and benefits of the project

3) Project Description

- i. Cost of project and time of completion.
- ii. Products with capacities for the proposed project.
- iii. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.
- iv. List of raw materials required and their source along with mode of transportation.
- v. Other chemicals and materials required with quantities and storage capacities
- vi. Details of Emission, effluents, hazardous waste generation and their management.
- vii. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)
- viii. Process description along with major equipments and machineries, process flow sheet (quantative) from raw material to products to be provided
- ix. Hazard identification and details of proposed safety systems.
- x. Expansion/modernization proposals:
 - a. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing Iexisting operation of the project from SPCB shall be attached with the EIA-EMP report.
 - b. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification

**STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR
PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.

4) Site Details

- i. Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.
- ii. A toposheet of the study area of radius of 10km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)
- iii. Details w.r.t. option analysis for selection of site
- iv. Co-ordinates (lat-long) of all four corners of the site.
- v. Google map-Earth downloaded of the project site.
- vi. Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.
- vii. Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.
- viii. Landuse break-up of total land of the project site (identified and acquired), government/private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)
- ix. A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area
- x. Geological features and Geo-hydrological status of the study area shall be included.
- xi. Details of Drainage of the project upto 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects)
- xii. Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.
- xiii. R&R details in respect of land in line with state Government policy.

5) Forest and wildlife related issues (if applicable):

- i. Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)
- ii. Landuse map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (*in case of projects involving forest land more than 40 ha*)

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

- iii. Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.
- iv. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.
- v. Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.
- vi. Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.

6) Environmental Status

- i. Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.
- ii. AAQ data (except monsoon) at 8 locations for PM10, PM2.5, SO₂, NO_x, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.
- iii. Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.
- iv. Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.
- v. Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC, if yes give details.
- vi. Ground water monitoring at minimum at 8 locations shall be included.
- vii. Noise levels monitoring at 8 locations within the study area.
- viii. Soil Characteristic as per CPCB guidelines.
- ix. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.
- x. Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.
- xi. Socio-economic status of the study area.

**STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR
PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

7) Impact and Environment Management Plan

- i. Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.
- ii. Water Quality modelling - in case of discharge in water body.
- iii. Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport shall be examined.
- iv. A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.
- v. Details of stack emission and action plan for control of emissions to meet standards.
- vi. Measures for fugitive emission control
- vii. Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.
- viii. Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.
- ix. Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.
- x. Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.
- xi. Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.

STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

- xii. Action plan for post-project environmental monitoring shall be submitted.
- xiii. Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.

8) Occupational health

- i. Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers
- ii. Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.
- iii. Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,
- iv. Annual report of health status of workers with special reference to Occupational Health and Safety.

9) Corporate Environment Policy

- i. Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.
- ii. Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.
- iii. What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.
- iv. Does the company have system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report.

10) Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.

11) Enterprise Social Commitment (ESC)

- i. Adequate funds (at least 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time

**STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR
PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

bound action plan shall be included. Socio-economic development activities need to be elaborated upon.

- 12) Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.
- 13) 'A tabular chart with index for point wise compliance of above TOR.

B. SPECIFIC TERMS OF REFERENCE FOR EIA STUDIES OF SODA ASH

1. Complete process flow diagram describing each unit, its processes and operations, along with material and energy inputs and outputs (material and energy balance).
2. Details on requirement of raw materials (sea water, lime-stone, coke, ammonia, additives, etc.), its source and storage at the plant.
3. Details of handling ammonia and risk assessment.
4. Details on water balance including water use, quantity of effluent generated, recycled and reused and its impact of discharge to receiving water body.
5. 5. Detail so effluent treatment plant, inlet and treated water quality with specific efficiency of each treatment unit in reduction in respect of all concerned/ regulated environmental parameters.
6. Details of CO₂ emissions including its quantum per tone of soda ash.
7. Management plan for solid waste generation (fines of lime stone, grits, brine sludge etc.), storage, utilization and disposal modes.
8. In case of coast at plants details on extraction of seawater and effluent disposal, development of solar salt works based on sea water evaporation, etc.,.
9. Details on ground water quality and surface water quality of near by waters ounces and other surfaced rains. The parameters of water quality may include Cl⁻, Ca²⁺, Na⁺, SO₄²⁻, NH₄⁺, Suspended solids* etc. (*- As applicable)
10. Ambient air quality should include NH₃.

Final Environmental Impact and Risk Assessment Study for
"Greenfield Chemical Complex" of GHCL Ltd.

(Light Soda Ash Plant of Capacity 3000 TPD, Dense Soda Ash 1500 TPD, Sodium Bicarbonate 600 TPD with Solid Fuel based Captive Co-generation Power Plant (120 MW capacity), Seawater Intake and Effluent Disposal System)

Village Bada, Taluka Mandvi, District Kutch, Gujarat"



Sponsor:
GHCL Limited,
GHCL House,
Opp. Punjabi Samaj Seva Hall, Navrangpura
Ahmedabad

Schedule: 4(e), Category A
TOR Letter: IA-J-11011/293/2021-IA-II(I)
Baseline Period: December 2019 – February 2020



Council of Scientific and Industrial Research (CSIR)
National Environmental Engineering Research Institute (NEERI)
Nehru Marg, Nagpur 440 020 (Maharashtra)

November 2022

Final Environmental Impact and Risk Assessment Study for
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(Light Soda Ash Plant of Capacity 3000 TPD, Dense Soda Ash 1500 TPD, Sodium Bicarbonate 600 TPD with Solid Fuel based Captive Co-generation Power Plant (120 MW capacity), Seawater Intake and Effluent Disposal System)

Village Bada, Taluka Mandvi, District Kutch, Gujarat"



Sponsor
GHCL Limited,
Ahmedabad



Council of Scientific and Industrial Research (CSIR)
National Environmental Engineering Research Institute (NEERI)

Nehru Marg, Nagpur 440 020

(QCI/NABET Accreditation letter no. NABET/EIA/2124/RA0227)

November 2022

GHCL Limited**UNDERTAKING for M/s. GHCL Limited.**

I, **Shri NN Radia** – Chief Operating Officer (COO) of **M/s. GHCL Limited** located at Village Bada, Taluka Mandvi, District Kutch, Gujarat **do hereby give undertaking** with reference to MoEF & CC O.M. No. J-11013/41/2006-IA.II.(I) dated 05th October 2011, that the data and information given in the Environmental Impact Assessment (EIA) report are factually correct and we will responsible for any discrepancy in the EIA report.

We also undertake that content including information & data of the EIA report is own by us and data or information not taken from any other EIA report.

The above stated fact is true to the best of my knowledge.

Date: 17.11.2022

Place: Ahmedabad

For M/s. GHCL Limited
Shri NN Radia -
Chief Operating Officer (COO)

GHCL House, Swastik Society, Opp. Punjabi Hall, Navrangpura, Ahmedabad, Gujarat-380009, India Ph. : +91-079-26434100
CIN : L24100GJ1983PLC006513, E-mail : ghclinfo@ghcl.co.in, Website : www.ghcl.co.in

Head Office : GHCL House, B - 38, Institutional Area, Sector - 1, Noida, Uttar Pradesh - 201301, India Ph. : +91-120-2535335, 3350000, Fax : +91-120-2535209



National Environmental Engineering Research Institute (NEERI)

I, Dr. R.J. Krupadam, **Senior Principal Scientist, National Environmental Engineering Research Institute (NEERI)** located at Nehru Marg, Nagpur, Maharashtra 440020, **do hereby give undertaking** with reference to MoEF&CC O.M. No. J-11013/41/2006-IA. II. (I) dated 04th August 2009, that we have prepared EIA report M/s. GHCL Limited. located at **Village Bada, Taluka Mandvi, District Kutch, Gujarat** as per Terms of Reference (ToR) prescribed wide letter no.: **No. IA-J-11011/293/2021-IA-II(I)** dated **10th August 2021**. The stated ToR have been complied with and the data mentioned in the EIA report are factually correct. CSIR-NEERI is a NABET accredited for materials manufacturing sector such as chlor-alkali. This undertaking is subjected NABET clearance on this project.

The above stated fact is true to the best of my knowledge.

Date: 29.11.2022
Place: Nagpur

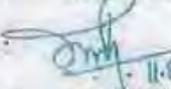
For, M/s. National
Environmental Engineering
Research Institute (NEERI)

Dr. R.J. Krupadam
Senior Principal Scientist &
Project Leader

डॉ. आर. जे. कृपादम
एन.एस.सी.(टिक), पी.एच.डी., एफ.आर.एस.सी.
वरिष्ठ प्रधान वैज्ञानिक एवं प्राध्यापक
समन्वयक, ए.सी.एस.आई.आर.
सी.एस.आई.आर.-राष्ट्रीय पर्यावरण अभियांत्रिकी अनुसंधान संस्थान(नीरी)
नेहरू मार्ग, नागपुर-440 020 (भारत)

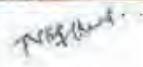
Declaration by Experts Contributing to the *Environmental Impact and Risk Assessment & Risk Assessment Study for Greenfield Chemical Complex of GHCL Ltd. At Village Bada, Taluka Mandvi, District Kutch, Gujarat.*

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA coordinator : **Dr R.J. Krupadam**
 Signature & Date :  11.8.2021
 Period of involvement : **April 2019 – July 2021**
 Contact information : **Senior Principal Scientist,
 CSIR-NEERI, Nehru Marg, Nagpur 440020
 Ph: +91 712 2249884, Fax: +91 712 2249896**

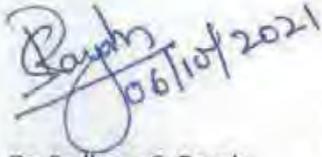
EIA Co-coordinator : **Dr. M. Suresh Kumar**

Functional Area Experts/TM :

Sr. No.	Functional Areas	Name of the Expert/s	Involvements (period and task**)	Signature and Date
1	Air pollution Monitoring Prevention and Control (AP)/Air Quality Modeling and Prediction (AQ)	Dr. T.V.B.P.S. Rama Krishna	Air Quality AQ	
2	Water Pollution Monitoring Prevention and Control(WP)	Dr. R. J. Krupadam Er. M. Karthik Mr. Y.J Baseshankar (TM)	Water Quality ETP Evaluation, Water EMP Marine Water Quality Water Quality Monitoring	  
3	Noise & Vibration (NV)	Dr. G.L. Bodhe Mr. Guddu Kumar (TM)	Noise Monitoring Prediction of Impacts and EMP	
4	Socio-economic Aspects (SE)	Dr. G.K. Khadse Mr. Sanjay Bodhale	Socio-economic Status Quality of Life	
5	Soil Conservation (SC)and Hydrogeology (Hg)	Dr. R.J. Krupadam Ms. Pravin Naoghare (TM)	Soil Conservation Soil Quality	 
6	Land-use & Land cover (LULC)	Dr. Ritesh Vijay	Remote Sensing & GIS for LULC	
7	Risk Assessment & Hazard Management (RH)	Dr. R. J. Krupadam Dr. Santosh Ghuge	Risk Assessment Hazard Management	 

Declaration by the Head of the accredited consultant organization

I, Dr. Sadhana S. Rayalu, hereby, confirm that the above-mentioned experts prepared the "Environmental Impact and Risk Assessment study for Greenfield Chemical Complex of GHCL Ltd., at Village Bada, Taluka Mandvi, District Kutch, Gujarat State. I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Signature	:		
Name	:	Dr. Sadhana S. Rayalu	<p>निदेशक / Director जी.एस.आई.एल.-राष्ट्रीय पर्यावरण अभियांत्रिकी अनुसंधान संस्थान CSIR-National Environmental Engineering Research Institute नेहरू मार्ग /, नागपुर-440 020 (भारत) Nehru Marg, Nagpur-440 020 (India)</p>
Designation	:	Senior Most Scientist/In-charge	
Name of the EIA Consultant Organization	:	CSIR-NEERI	
NABET Certificate No & Issue date	:	NABET/EIA/1821/SA 0119, 01.07.2021 (Renewal applied)	



Index for point-wise compliance of ToR

S. N	ToR	Page No.
1.	Executive Summary of the project	Executive Summary of the project is provided along with EIA Report. Please refer Pg. Nos.: ES-1 to ES-21.
2. Introduction		
i.	Details of the EIA Consultant including NABET accreditation	CSIR-NEERI, Nagpur is the lead EIA consultant (Pl. refer Chapter 1, Section 1.2 Pg No. 1.2) The NABET accreditation is given in Chapter 12, Section 12.1.12, Pg. No. 12.15.
ii.	Information about the project proponent	Pl refer Chapter 1, Section 1.1 and 1.2, Pg. No. 1.1 and 1.2 of EIA report.
iii.	Importance and benefits of the project	Please refer Chapter 1, Section 1.3.1, Pg. No.: 1.3. Also, the details of project benefits are given in Chapter 8. The plant will create direct employment in phased manner for about 1200 (operational phase) skilled as well as semi-skilled staff and indirectly large number of unskilled manpower will be engaged for the project.
3. Project Description		
i.	Cost of project and time of completion	Pl refer Chapter 2, Section 2.5, Pg. No.:2.8 & 2.9 of EIA report.
ii.	Products with capacities for the proposed project.	Pl refer Chapter 2, Section 2.1 Pg. No.:2.1 of EIA report.
iii.	If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	Not Applicable as proposed project is Greenfield Chemical Complex.
iv.	List of raw materials required and their source along with mode of transportation.	Pl refer Chapter 2, Section 2.6, Pg. No.: 2.9-2.10. The major raw material for the project are Solar salt, Lime Stone, Coke, Ammonia, Coal and Lignite.

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v.	Other chemicals and materials required with quantities and storage capacities	PI refer Chapter 2, Section 2.6 Pg No.: 2.12 for details of raw materials and chemicals.
vi.	Details of Emission, effluents, hazardous waste generation and their management.	Refer Chapter 4, Section 4.1.1 and 4.1.3 Pg. No.: 4.1 – 4.13. Section 4.3.2 for effluents Pg. No.: 4.31-4.33; Section 4.4 Pg. No.: 4.35 for hazardous waste management. PI refer Chapter 10, Section 10.2 and 10.3 Pg No.: 10.4-10.8 for management.
vii.	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)	The water requirement will be met from seawater off Bada Coast and power requirement will be met from solid fuel based captive co-generation power plant of 120 MW capacity. Refer Chapter 4 Section 4.3.1 Pg. No.: 4.30 & 4.31 for water requirement. Refer Chapter 2 Section 2.6 Pg. No.:2.24 Captive Co generation Power plant for power requirement. Refer Chapter 8 Section 8.1 Pg.no. 8.1, The plant will create direct employment in phased manner for about 1200 skilled as well as semi-skilled staff and indirectly large no. of unskilled manpower will be engaged for the project.
viii.	Process description along with major equipment and machineries, process flow sheet (quantitative) from raw material to products to be provided	PI refer Chapter 2 Section 2.6 Pg. No.: 2.14-2.23 of EIA report.
ix.	Hazard identification and details of proposed safety systems.	PI refer Chapter 7, Section 7.5.2, Pg. No.: 7.6-7.9 and Section 7.5.6 Pg.No.: 7.28 to 7.32 and Section 7.5.7 Pg.No.: 7.33 to 7.36 of EIA Report.
x.	Expansion/modernization proposals: a. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional	Not Applicable (as the proposed project is Development of Greenfield Chemical Complex).



	<p>Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing existing operation of the project from SPCB shall be attached with the EIA-EMP report.</p> <p>In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Con-sent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.</p>	
4. Site Details		
i.	<p>Location of the project site covering village, Taluka / Tehsil, District and State, Justification for selecting the site, whether other sites were considered.</p>	<p>The site is located near Village Bada, Taluka Mandvi, District kutch. The site is selected after examining 5 alternative sites.</p> <p>Pl refer Chapter 1, Section 1.3, Pg. No.: 1.2, Chapter 2 Section 2.3 Pg. No.: 2.2-2.6 and, Chapter 5, Section 5.2, Pg. No.: 5.2-5.9 of EIA report.</p>
ii.	<p>A toposheet of the study area of radius of 10 km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet (including all eco-sensitive areas and environmentally sensitive places)</p>	<p>High resolution satellite images were used for real scenario at project site and nearby areas, pl refer Chapter 3, Section 3.5.1, Pg. No.: 3.72-3.79.</p> <p>A toposheet is provided for the study area, Pg.No.: 3.79</p>
iii.	<p>Details w.r.t. option analysis for selection of site</p>	<p>The proposed site near Village Bada, Taluka Mandvi, is selected after examining 5 alternative sites. Chapter 5, Section 5.2, Pg. No.: 5.2-5.9 of EIA report.</p>

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iv.	Co-ordinates (lat-long) of all four corners of the site.	Refer Chapter 2, Section 2.3, Pg. No.:2.2 of EIA Report.
v.	Google map-Earth downloaded of the project site.	Refer Chapter 2, Figure 2.2, Pg. No.: 2.5 of EIA Report.
vi.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.	As the proposal is for Greenfield Chemical Complex there is no existing unit and is not located within any industrial estate. PI refer Chapter 2, Figure 2.3 (the layout of the project area) Pg. No.: 2.7 of EIA report.
vii.	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	PI refer Chapter 3, Fig. 3.5.2, Pg. No.: 3.60 of EIA Report.
viii.	Land use break-up of total land of the project site (identified and acquired), government/private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included.	PI refer Chapter 3, Section 3.5.2.2 Pg. No.: 3.73 to 3.78 of EIA report.
ix.	A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area	Refer Chapter 3, Section 3.5.2, Pg. No.: 3.74 of EIA report. In the study area, there is no major industries observed during field studies in 2019-2021.
x.	Geological features and Geo-hydrological status of the study area shall be included.	PI refer enclosed Annexure IV Hydrogeological Assessment Report Chapter 3, Pg. No.: 17 & 18.
xi.	Details of Drainage of the project up to 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided (mega green field projects)	Drainage patterns reveals that the general slope of the area is towards south west. PI refer Chapter 7, Section 7.1, Pg. No.: 7.1 of EIA Report. Also refer enclosed Annexure IV Hydrogeological Assessment Report Chapter 2 Pg.No.: 2 to 4. All the rivers and streams are seasonal only. The general drainage of area is dendritic and sub parallel.
xii.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the	M/s GHCL has applied to Industries Commissioner and District Collector for allotment of aforesaid land. Industries Commissioner has granted In Principle

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	land.	approval for Bonafied Industrial Purpose. District Collector has initiated actions for allotment of Govt. waste land.
xiii.	R&R details in respect of land in line with state Government policy.	NA
5. Forest and wildlife related issues (if applicable):		
i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	There is no Forest land within proposed Greenfield Chemical Complex plant boundary. However some portion of seawater intake and effluent disposal pipelines needs to be laid through Unclass Forest area for which M/s GHCL has made Forest Diversion application for area 0.9689 Ha.
ii.	Land use map based on High resolution satellite imagery (GPS) of the pro-posed site delineating the forestland (in case of projects involving forest land more than 40 ha)	Not Applicable
iii.	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.	M/s GHCL applied for Forest Clearance vide Online proposal FP/GJ/Others/147527/2021 dtd. 21/09/202. The registration and processing fees has been deposited by User agency i.e GHCL Ltd. The proposal is pending with DFO for further processing.
iv.	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	Not Applicable (as project is not located within such area).
v.	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if	PI refer enclosed Annexure III report on Ecological Study & Wildlife Conservation Plan Chapter 6, Pg. No.:48.

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	any exists in the study area.	
vi.	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.	Not Applicable
6. Environmental Status		
i.	Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	PI refer Chapter 3, Section 3.1.3, Pg. No.: 3.2; and Chapter 4, Section 4.1.2, Pg. No.: 4.10 of EIA report.
ii.	AAQ data (except monsoon) at 8 locations for PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.	PI refer Chapter 3, Section 3.1 and Section 3.1.4 Page no 3.6-3.16 of EIA report. The ambient air quality around the proposed project within 10 km radius was monitored at ten stations. Apart from PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO other parameters monitored are NH ₃ , O ₃ , particulate matter associated metals, Benzene and benzo (a) pyrene.
iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQPM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an Annexure to the EIA Report.	Please refer Annexure X for raw-data.
iv.	Surface water quality of nearby River (100 m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/ MoEF & CC guidelines.	River Vengadi Nadi lies West of Project location and it's a seasonal river. It receives run off only during heavy monsoon. PI refer Chapter 3, Section 3.4, Pg. No.: 3.40. PI refer Annexure II MEIA Report prepared by CSIR NIO Chapter 3, Section 3.4, Pg. No.: 91 & 92.

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v.	Whether the site falls near to polluted stretch of river identified by the CPCB/ MoEF & CC, if yes give details.	No
vi.	Ground water monitoring at minimum 8 locations shall be included.	Ground water samples were collected from 11 locations including 8 dug well and 3 bore well samples within study area. PI refer Chapter 3, Section 3.3.2, Pg. No.: 3.27-3.29 of EIA report.
vii.	Noise levels monitoring at 8 locations within the study area.	PI refer Chapter 3, Section 3.2, Pg. No.: 3.17-3.26 of EIA report.
viii.	Soil Characteristic as per CPCB guidelines	PI refer Chapter 3, Section 3.5.1, Pg. No.: 3.57-3.72 of EIA report.
ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	PI refer Chapter 3, Section 3.2.3, Pg. No.: 3.17-3.18 of EIA report.
x.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	PI refer Chapter 3, Section 3.6, Pg. No.: 3.80-3.108 of EIA report. The detailed report entitled Ecology Study and Wildlife Conservation plan is enclosed as Annexure III.
xi.	Socio-economic status of the study area.	PI refer Chapter 3, Section 3.7, Pg. No.: 3.109-3.138 of EIA report.
7. Impact and Environment Management Plan		
i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the	PI refer Chapter 4, Section, 4.1.4, Pg. No.: 4.11 - 4.13 of EIA Report. To predict the impacts on ambient air quality due to proposed units, data on emission scenario and micrometeorology collected along with historical data collected from Indian Meteorology Department (IMD) were used to predict Ground Level Concentrations (GLCs) of SO ₂ , NO _x , PM ₁₀ and NH ₃ for

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	AAQ. Cumulative im-pact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	different temporal variations. AERMOD (American Meteorological Society Environmental Protection Agency Regulatory Model) model was used to predict GLCs.
ii.	Water Quality modelling - in case of discharge in water body.	PI refer Annexure II CSIR NIO MEIA Report which discusses numerical modeling for Effluent Dispersion Chapter 4 120 to 163.
iii.	Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor cum-rail transport shall be examined.	PI refer Chapter 4, Section 4.1.4.3, Pg. No.: 4.13 of EIA Report. Complied.
iv.	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.	PI refer Chapter 2, Section 2.6, Pg. No.:2.26-2.28; and Chapter 4, Section 4.3.2, Pg. No.: 4.31 - 4.36 of EIA Report.
v.	Details of stack emission and action plan for control of emissions to meet standards.	PI refer Chapter 4, Section 4.1.4.2, Pg. No.: 4.12 and Chapter 10, Section 10.3.2.1, Pg. No.: 10.5-10.6 of EIA Report. The major source of emission is from process stacks and boiler stack. The expected pollutants are PM, SO ₂ , NO _x and NH ₃ .
vi.	Measures for fugitive emission control	PI refer Chapter 4, Section 4.1.4.2, Pg. No.: 4.12; and Chapter 10, Section 10.3.2.1, Pg. NO.: 10.5 of EIA Report. Complied.

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vii.	Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/ recover techniques, Energy conservation, and natural resource conservation.	PI refer Chapter 4, Section 4.4, Pg. No.:4.35 and Chapter 10, Section 10.3.2.4 Pg. No.: 10.4 of EIA report. Fly Ash utilization in Cement Industries can be referred from Annexure VIII. PI refer Chapter 10, Section 10.5, Pg. No.: 10.11-10.12 of EIA report.
viii.	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Fly Ash utilization in Cement Industries can be referred from Annexure VIII.
ix.	Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Refer Chapter 10, Section, 10.6, Pg. No.: 10.12-10.13 of EIA Report. GHCL will develop green belt in 33% of total plant area in and around the plant in a phased manner. The plantation will be done all along the periphery of the plant and on the sides of internal roads.
x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	PI refer Chapter 7, Section 7.1 Pg. No.: 7.1-7.2 of EIA Report. GHCL proposes to take up rain water harvesting by harnessing the roof top rain water from different buildings and proposes to collect it in water tank and use it for general plant purposes. Details of rain water harvesting plan are also given in enclosed Annexure IV Hydrogeological Report Chapter 7 Pg. No.: 29.
xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	Refer Chapter 10, Section 10.9 of EIA report. The total capital cost / investment on environmental protection/ improvement measures is envisaged to be around Rs. 200 Cr. A provision of Rs. 10.0 million to be earmarked for the biodiversity

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		management plan to be implemented in the project area during construction phase and operation phase. For periodic monitoring of the marine area environment during project construction phase (considering 2 years), a provision of Rs. 5.0 million to be earmarked. For operation phase, Rs. 3.0 million per year to be kept provision for the monitoring. PI refer Chapter 9 Section 9.5, Page 206 of MEIA report by CSIR NIO.
xi.	Action plan for post-project environmental monitoring shall be submitted.	PI refer Chapter 6 for Monitoring Programme details of EIA Report. Also, refer Chapter 9 Page no. 202 of CSIR NIO MEIA Report.
xii.	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	PI refer Chapter 7, Section 7.5.8, Pg. No.:7.38-7.58 of EIA Report.
8. Occupational Health		
i.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers	Public liability insurance: For the contractor's workman policy will be taken up in the contracts and separately for regular GHCL staff.
ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre placement and periodical examinations give the details of the same. Details regarding last month analyzed data of above-mentioned parameters as per age, sex, duration of exposure and department-wise	Pre-employment and Periodical medical test will be done for Greenfield Chemical Complex.
iii.	Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are	Refer Chapter 7, Section 7.5.7.4 Pg. No.: 7.38 of EIA Report.

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	within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,	
iv.	Annual report of health status of workers with special reference to Occupational Health and Safety.	This will be done for the proposed Greenfield Chemical Complex.
9. Corporate Environment Policy		
i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	Yes. The Environment Policy can be referred from Annexure IX.
ii.	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms /conditions? If so, it may be detailed in the EIA.	Yes. The Environment Policy can be referred from Annexure IX of EIA Report.
iii.	What is the hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Pl refer Chapter 10, Section 10.7 Pg. No.: 10.16 of EIA Report.
iv.	Does the company have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report.	Yes, pl refer Chapter 10, Section 10.7 Page no 10.14-10.15 of EIA Report.
10. Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.		Pl refer Chapter 10, Section 10.2.2, Pg. No.: 10.2-10.3 of EIA Report.
11. Enterprise Social Commitment (ESC).		As per MoEF&CC Office Memorandum F.NO. 22-67/2017-IA III, MoEF&CC, New
i.	Adequate funds (at least 2.5 % of	

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the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio-economic development activities need to be elaborated upon.	Delhi, dated 1 st May 2018 GHCL Ltd. has earmarked 0.5 % of capital investment (Approx Rs. 18.04 crores) towards the Corporate Environment Responsibility. For details of CER activities please refer Section 8.4. Public hearing minutes of meeting with action plan is attached as Annexure-XI.
12. Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case	Nil
13. A tabular chart with index for point-wise compliance of above TOR.	Complied. Refer Pg. No I.i – I.xiii of EIA Report.

Specific ToR for the Proposed Project

1	Complete process flow diagram describing each unit, its processes and operations, along-with material and energy inputs and outputs (material and energy balance).	PI refer Chapter 2, Section 2.6, Pg. No.: 2.13 of EIA report. The process flow diagram of soda ash (Pg. No.: 2.15) processing units and sodium bicarbonate (Pg. No.: 2.23) are provided.
2	Details on requirement of raw materials (sea water, lime-stone, coke, ammonia, additives, etc.), its source and storage at the plant.	The major raw materials for the project are Solar salt, Limestone, Coke, Lignite etc. PI refer Chapter 2, Section 2.6, Pg. No.: 2.9-2.12 of EIA Report.
3	Details of handling ammonia and risk assessment.	PI refer Chapter 7, Section 7.5.4.4 and Section 7.5.6 Pg. No.: 7.22-7.28 of EIA Report.
4	Details on water balance including water use, quantity of effluent generated,	PI refer Chapter 4 Section 4.3 Pg. No.: 4.30 to 4.34 for water and effluent related

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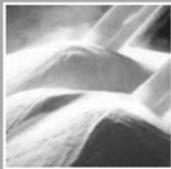
	recycled and reused and its impact of discharge to receiving water body.	details. PI refer Annexure II MEIA CSIR-NIO report for impact of discharge on receiving water body Chapter 6, Section 6.3.2 Pg. No.: 174-180.
5	Details of effluent treatment plant, inlet and treated water quality with specific efficiency of each treatment unit in reduction in respect of all concerned/regulated environmental parameters.	PI refer Chapter 4, Section 4.3.2, Pg. No.:4.31-4.34 of EIA Report.
6	Details of CO ₂ emissions including its quantum per ton of soda ash.	PI refer Chapter 4, Section 4.1.3, Pg. No. 4.10 of EIA report.
7	Management plan for solid waste generation (fines of lime stone, grits, brine sludge etc.), storage, utilization and disposal modes.	PI refer Chapter 10 Section 10.3.1.3 and 10.3.3.4 Pg. No.: 10.7-10.8 and 10.11-12 of EIA report. Refer Chapter 2, Section 2.6 Pg. No.: 2.25 of EIA report.
8	In case of coast at plants details on extraction of seawater and effluent disposal, development of solar salt works based on sea water evaporation.	PI refer Chapter 2, Section 2.8 and 2.9 Pg. No. 39 & 44 of Annexure II CSIR NIO MEIA report.
9	Details on ground water quality and surface water quality of nearby waters ounces and other surfaced rains. The parameters of water quality may include Cl ⁻ , Ca ²⁺ , Na ⁺ , SO ₄ ²⁻ , NH ₄ ⁺ , suspended solids* etc. (*- As applicable)	PI refer Chapter 3, Section 3.3 Pg. No.: 3.27 to 3.39 of EIA Report. Surface water samples from 6 locations and Ground water samples from 11 locations were collected and analyzed for various physico-chemical and biological parameter.
10	Ambient air quality should include NH ₃	Ammonia is measured in ambient air at 10 locations. PI refer Chapter 3 Section 3.1.4 of EIA Report.



IL&FS | Environment

TECHNICAL EIA GUIDANCE MANUAL FOR SODA ASH INDUSTRY

Prepared for
The Ministry of Environment and Forests
Government of India



by
IL&FS Ecosmart Limited
Hyderabad

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TABLE OF CONTENTS

1. INTRODUCTION TO THE TECHNICAL EIA GUIDANCE MANUALS PROJECT	1-1
1.1 Purpose.....	1-2
1.2 Project Implementation	1-4
1.3 Additional Information.....	1-4
2. CONCEPTUAL FACETS OF EIA	2-1
2.1 Environment in EIA Context.....	2-1
2.2 Pollution Control Strategies	2-2
2.3 Tools for Preventive Environmental Management.....	2-2
2.3.1 Tools for assessment and analysis	2-3
2.3.2 Tools for action.....	2-5
2.3.3 Tools for communication.....	2-10
2.4 Objectives of EIA.....	2-10
2.5 Types of EIA	2-11
2.6 Basic EIA Principles	2-12
2.7 Project Cycle	2-13
2.8 Environmental Impacts	2-13
2.8.1 Direct impacts.....	2-14
2.8.2 Indirect impacts	2-14
2.8.3 Cumulative impacts	2-15
2.8.4 Induced impact	2-15
2.9 Significance of Impacts.....	2-16
2.9.1 Criteria/methodology to determine the significance of the identified impacts..	2-17
3. ABOUT SODA ASH INDUSTRY INCLUDING PROCESS AND POLLUTION CONTROL TECHNOLOGIES	3-1
3.1 Introduction	3-1
3.1.1 Structure and status of Indian industry	3-1
3.1.2 Present industry dynamics	3-2
3.1.3 Uses in industrial sectors	3-2
3.2 Scientific Aspects.....	3-4
3.2.1 Raw materials	3-5
3.2.2 Industrial Processes	3-6
3.2.3 Co-products	3-14
3.3 Quantitative analysis of input and output.....	3-16
3.3.1 Specific raw material consumption and emission factors.....	3-16
3.4 Sources of Environmental Pollution.....	3-18
3.4.1 Gaseous emissions.....	3-18
3.4.2 Liquid effluents.....	3-20
3.4.3 Solid waste.....	3-21
3.5 Control of Pollution from the Industry	3-22



Table of Contents

3.5.1	Gaseous emissions management.....	3-22
3.5.2	Liquid effluent management.....	3-24
3.5.3	Solid waste management	3-27
3.6	Summary of Applicable National Regulations.....	3-28
3.6.1	General description of major statutes	3-28
3.6.2	General standards for discharge of environmental pollutants	3-28
3.6.3	Industry-specific requirements	3-28
4.	OPERATIONAL ASPECTS OF EIA	4-1
4.1	Coverage of the Industry under the Purview of Notification	4-1
4.1.1	Application for prior environmental clearance.....	4-2
4.1.2	Siting guidelines	4-3
4.2	Scoping for EIA Studies.....	4-4
4.2.1	Pre-feasibility report.....	4-5
4.2.2	Guidance for providing information in Form 1	4-6
4.2.3	Identification of appropriate valued environmental components	4-7
4.2.4	Methods for identification of impacts.....	4-7
4.2.5	Testing the Significance of Impacts	4-13
4.2.6	Terms of reference for EIA studies	4-13
4.3	Environmental Impact Assessment	4-18
4.3.1	EIA team.....	4-19
4.3.2	Baseline quality of the environment	4-19
4.3.3	Impact prediction tools	4-22
4.3.4	Significance of the impacts.....	4-22
4.4	Social Impact Assessment	4-23
4.5	Risk Assessment.....	4-26
4.5.1	Disaster management plan (DMP).....	4-29
4.6	Mitigation Measures.....	4-32
4.6.1	Important considerations for mitigation methods.....	4-32
4.6.2	Hierarchy of elements of mitigation plan	4-33
4.6.3	Typical mitigation measures.....	4-34
4.7	Environmental Management Plan	4-38
4.8	Reporting.....	4-39
4.9	Public Consultation	4-41
4.10	Appraisal.....	4-44
4.11	Decision Making	4-45
4.12	Post-clearance Monitoring Protocol.....	4-47
5.	STAKEHOLDERS' ROLES AND RESPONSIBILITIES	5-1
5.1	EAC.....	5-3

LIST OF TABLES

Table 3-1: Plant Area/Operations	3-9
Table 3-2: Raw material consumption per ton of co-product	3-14
Table 3-3: Major Emissions Levels from Solvay Soda Ash Process	3-17
Table 3-4: Wastewater from distillation	3-20
Table 3-5: Effluent from Brine Purification (Typical Composition)	3-21
Table 3-6: Solid effluents from soda ash process	3-22
Table 3-7: Vent gas from lime kilns after cleaning.....	3-23
Table 3-8: Vent gas from column section after washing	3-23
Table 3-9: Typical quantities of CO ₂ and NH ₃ in the filter air after cleaning.....	3-24
Table 3-10: Effluent standards.....	3-28
Table 3-11: Dual Process Soda Ash Plants.....	3-28
Table 4-1: Advantages and Disadvantages of Impact Identification Methods	4-7
Table 4-2: Matrix of Impacts	4-10
Table 4-3: List of Important Physical Environment Components and Indicators of EBM.....	4-20
Table 4-4: Choice of Models for Impact Predictions: Risk Assessment.....	4-27
Table 4-5: Typical Mitigation Measures.....	4-35
Table 4-6: Structure of EIA Report.....	4-39
Table 5-1: Roles and Responsibilities of Stakeholders Involved in Prior Environmental Clearance	5-1
Table 5-2: Organization-specific Functions.....	5-2
Table 5-3: EAC: Eligibility Criteria for Chairperson / Members / Secretary	5-5

LIST OF FIGURES

Figure 2-1: Inclusive Components of Sustainable Development.....	2-1
Figure 2-2: Types of Impacts.....	2-14
Figure 2-3: Cumulative Impact.....	2-15
Figure 3-1: Process Block Diagram for the Manufacture of Soda Ash by the Solvay Process	3-9
Figure 3-2: Typical Process for the Manufacture of Refined Sodium Bicarbonate.....	3-16
Figure 4-1: Prior Environmental Clearance Process.....	4-2
Figure 4-2: Approach for EIA Study	4-18
Figure 4-3: Risk Assessment – Conceptual Framework.....	4-27
Figure 4-4: Comprehensive Risk Assessment - At a Glance	4-28
Figure 4-5: Elements of Mitigation.....	4-33

ANNEXURES

Annexure I

A Compilation of Legal Instruments

Annexure II

General Standards for Discharge of Environmental Pollutants as per CPCB

Annexure III

Form 1 (Application Form for Obtaining EIA Clearance)

Annexure IV

Critically Polluted Industrial Areas and Clusters / Potential Impact Zone

Annexure V

Pre-feasibility Report: Points for Possible Coverage

Annexure VI

Types of Monitoring and Network Design Considerations

Annexure VII

Guidance for Assessment of Baseline Components and Attributes

Annexure VIII

Sources of Secondary Data

Annexure IX

Impact Prediction Tools

Annexure X

Composition of EAC

Annexure XI

Best Practices & Latest Technologies available and reference

ACRONYMS

AAQ	Ambient Air Quality
B/C	Benefits Cost Ratio
BAT	Best Available Technology
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
BOT	Build Operate Transfer
CaSO ₄	Calcium Sulfate
Ca(OH) ₂	Calcium Hydroxide
CCA	Conventional Cost Accounting
CER	Corporate Environmental Reports
CEAA	Canadian Environmental Assessment Agency
CO ₂	Carbon Dioxide
CFE	Consent for Establishment
CPCB	Central Pollution Control Board
CREP	Corporate Responsibility for Environmental Protection
CRZ	Coastal Regulatory Zone
DBO	Distiller Blowoff
DCW	Dharangadhra Chemical Works Ltd.
DfE	Design for Environment
DMP	Disaster Management Plan
EAC	Expert Appraisal Committee
ECI	Environmental Condition Indicators
EcE	Economic-cum-Environmental
EIA	Environmental Impact Assessment
EIS	Environmental Information System
EMA	Environmental Management Accounting
EMP	Environmental Management Plan
EMS	Environmental Management System
EPI	Environmental Performance indicators
ES	Environmental Statements
FCA	Full Cost Assessment
GHCL	Gujarat Heavy Chemicals Ltd.
HAZOP	Hazard and Operability Studies
HCl	Hydrochloric Acid
HTL	High Tide Level



Table of Contents

IL&FS	Infrastructure Leasing & Financial Services Limited
IVI	Importance Value Index
ISO	International Standard Organization
LCA	Life Cycle Assessment
LDAR	Leak Detection and Repair
LTL	Low Tide Level
MCA	Maximum Credible Accident
MEE	Multiple Effect Evaporators
MoEF	Ministry of Environment & Forests
Na ₂ CO ₃	Sodium Carbonate
NaCl	Sodium Chloride
NAQM	National Air Quality Monitoring
NGO	Non-Government Organizations
Nox	Nitrogen Oxides
O&M	Operation and Maintenance
OECD	Organization for Economic Co-operation and Development
PM	Particulate Matter
PPA	Participatory Poverty Assessment
PRA	Participatory Rural Appraisal
QA/QC	Quality Assurance/Quality Control
QRA	Quantitative Risk Assessment
SEA	Strategic Environmental Assessment
SEAC	State Level Expert Appraisal Committee
SEIAA	State Level Environment Impact Assessment Authority
SEZ	Special Economic Zone
SIA	Social Impact Assessment
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
TA	Technology Assessment
TACFL	Tuticorin Alkali Chemicals and Fertilizer Ltd.
TCA	Total Cost Assessment
TEQM	Total Environmental Quality Movement
TGM	Technical EIA Guidance Manual
ToR	Terms of Reference
UT	Union Territory
UTEIAA	Union Territory Level Environment Impact Assessment Authority
UTPCC	Union Territory Pollution Control Committee

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Acknowledgement

The Notification issued on the prior environmental clearance process by the Ministry of Environment and Forests (MoEF) on September 14, 2006 delegated substantial powers to the State Level Environment Impact Assessment Authorities (SEIAA) to grant environmental clearance for certain categories of developmental activities/projects. It was felt that proper guidance to the stakeholders would enhance appreciation of environmental impacts of proposed projects and possible mitigation measures. Further, such a guidance would also help ensure that decision making authorities across different States and Union Territories could adopt similar considerations and norms with due weightage for site-specific considerations.

We feel privileged to be part of the interventions being spearheaded by Sh. Jairam Ramesh, Hon'ble Minister, MoEF, Government of India, to mainstream environmental considerations in the decision making process. IL&FS Ecosmart as part of this important initiative, prepared Technical EIA Guidance Manuals for 27 identified development activities. In view of the diversity of 27 developmental activities entrusted to IL&FS Ecosmart Ltd., in consultation with the MoEF, an expert Peer and Core Committee was constituted to review and finalize each of the draft Manuals. The Manuals prepared by IL&FS were technically reviewed and up-dated by the respective sector-specific expert resource persons.

The Manuals designed by the Expert Committee have benefitted from the advise and feedback received from MoEF. The Manuals are designed to provide readers with an in-depth understanding of the environmental clearance mechanism, developmental activity specific environmental impacts with possible mitigation measures, environmentally compliant manufacturing/ production processes and pollution control technologies, etc.

IL&FS Ecosmart hopes that these Manuals are a step forward to realize the MoEF's desired objective of enhancing functional efficiency and effectiveness in the environmental clearance process. We hope the stakeholders will find the Manuals useful.

We take this opportunity to convey our appreciation to the MoEF team under the leadership of Mr. J.M. Mauskar, Additional Secretary, for the technical inputs, guidance and support extended throughout the project period for successful completion of the project. The technical guidance and support extended by the Expert Peer and Core Committee under the Chairmanship of Dr. V. Rajagopalan, former Chairman, Central Pollution Control Board and inputs of the sector-specific resource persons are gratefully acknowledged.


(Mahesh Babu)

15th November 2010

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FOREWORD

The Ministry of Environment & Forests (MOEF) introduced the Environmental Impact Assessment (EIA) Notification 2006 on 14th September 2006, which not only reengineered the entire environment clearance (EC) process specified under the EIA Notification 1994, but also introduced a number of new developmental sectors which would require prior environmental clearance. The EIA Notification 2006 has notified a list of 39 developmental sectors which have been further categorised as A or B based on their capacity and likely environmental impacts. Category B projects have been further categorised as B1 and B2. The EIA Notification 2006 has further introduced a system of screening, scoping and appraisal and for the setting up of Environment Impact Assessment Authority (EIAA) at the Central level and State Level Environment Impact Assessment Authorities (SEIAAs) to grant environmental clearances at the Central and State level respectively. The Ministry of Environment & Forests is the Environment Impact Assessment Authority at the Central level and 25 State Level Environment Impact Assessment Authorities (SEIAAs) have been set up in the various States/UTs. The EIA Notification 2006 also stipulates the constitution of a multi-disciplinary Expert Appraisal Committee (EAC) at the Centre and State level Expert Appraisal Committees (SEACs) at State/UT Level for appraisal of Category A or B projects respectively and to recommend grant/rejection of environmental clearance to each project/activities falling under the various sectors to the EIAA/SEIAAs respectively.

Although the process of obtaining environmental clearance consisting of Screening, Scoping and Appraisal and for undertaking public consultation including the process of conduct of Public Hearing has been elaborated under the EIA Notification 2006, the Notification itself provides for bringing out guidelines from time to time on the EIA Notification 2006 and the EC process with a view to bringing clarity on the EC process for expediting environmental clearance. This need was further reinforced after the constitution of SEIAAs and SEACs in various States, who were assigned the task for the first time and for addressing the concerns of standardization of the quality of appraisal and in reducing inconsistencies between SEACs/SEIAAs in granting ECs for similar projects in different States.

The Technical Guidance Manual of "Soda Ash Industry" sector describes types of EIA, process and pollution control technologies, operational aspects of EIA with model TOR of that Sector, technological options with cleaner production and waste minimization techniques,

monitoring of environmental quality, post clearance monitoring protocol, related regulations, and procedure of obtaining EC if linked to other clearances for e.g., CRZ, etc.

A Soda Ash plant is also characterised by very large volume of liquid and high gas flows, interdependency between unit operations and very high degree of recycle between units. Emphasis should be given to control Ammonia, Hydrogen Sulphide besides PM, SO₂, NO_x, Ammonia and CaCl₂ should be recovered. Standards notified by the Ministry for Soda Ash industry should be adhered to. The improvements are long term investments and in many case one particular technology is inter-dependent on another. The real environment benefits have also to be carefully assessed and taken into consideration. There is therefore no individual solution to produce a single list of best available technology.

India's industrial competitiveness and environmental future depends on Industries such as Soda Ash Industry adopting energy and resource efficient technologies. Recycling and reuse of materials is critical. To keep pace with changing technologies and needs of sustainable development, the manual would require regular updating in the future. The manual will be available on the MoEF website and we would appreciate receiving responses from stakeholders for further improvements.

I congratulate the entire team of IL&FS Ecosmart Ltd., experts from the sector who were involved in the preparation of the Manuals, Chairman and members of the Core and Peer Committees of various sectors and various Resource Persons whose inputs were indeed valuable in the preparation and finalization of the Manuals.



(Jairam Ramesh)

3.

ABOUT SODA ASH INDUSTRY INCLUDING PROCESS AND POLLUTION CONTROL TECHNOLOGIES

3.1 Introduction

Soda Ash (commercial name Sodium Carbonate) forms an important part of Indian inorganic chemical industry. It accounts for 50-60% of Chlor-alkali industry by turnover. It is a high volume, low-value product and finds application mainly in the production of detergents (42% light soda ash), glass (23% dense soda ash), chemicals (17% mainly light soda ash), sodium silicate, pulp & paper and water treatment.

3.1.1 Structure and status of Indian industry

The manufacture of soda ash in India started in 1932 at Dharangadhra in Gujarat with an installed capacity of 50 tonne per day under the name of Shri Shakti Alkali Works, which later became Dharangadhra Chemical Works Ltd. (DCW). This was followed by the entry of Tata Chemicals at Mithapur in Gujarat in 1994, with an installed capacity of 100 tonnes per day (TPD). In a span of 50 years it has grown to be the biggest soda ash unit in the country with daily capacity of 2000 tonne. In the same Saurashtra region, two more soda ash plants came up afterwards. Saurashtra Chemicals at Porbandar was commissioned in 1959 with a capacity of 200 tonne per day, which has been expanded to 800 tonne per day. Gujarat Heavy Chemicals Ltd. (GHCL) at Sutrapada, near Veraval was commissioned in 1988 with a capacity of 1200 tonne per day. All these four units in Saurashtra are based on Solvay process.

These three units were using modified Solvay process (Dual Process) in which ammonium chloride is the co-product. The first plant based on this technology was set up in 1959 at Varanasi, Uttar Pradesh in the name of Sahu Chemicals & Fertiliser with an installed capacity of 120 tonne per day, but since August 1988 this unit is lying idle. The other two units operating on dual process at a capacity of 200 tonne per day are Tuticorin Alkali Chemicals and Fertiliser Ltd (TACFL) at Tuticorin, Tamil Nadu (established in 1982), and Punjab National Fertiliser & Chemical at Nayanangal, Punjab (established in 1984). The present installed capacity of six soda ash manufacturing units is 17.09 lakh tonne. With expansion of existing soda ash manufacturing units and after commencement of new units, the total production of soda ash is estimated to be 27.4 lakh tonnes. Substantial quantity of soda ash was being imported up to 1987-88 (till the commissioning of Gujarat Heavy Chemicals Ltd in 1988) to meet the domestic demand.

Soda ash export potential does exist specially to the Middle-East and South-East Asia. Tata Chemicals, Gujarat Heavy Chemicals Ltd and Saurashtra Chemicals were exporting to Middle-East Asia in early 90s. Soda ash demand in India during the decade of 1999-2000 was about 26.80 lakh tonnes, which was met through expansion of existing units and with commencement of new companies. Nirma commissioned its Soda ash and Pure Water Plant (Editable salt) in 2000 and thereafter expanded capacity of Soda Ash in 2002 and Pure Water Plant (Editable salt) in 2007.

Raw materials for Solvay process are salt, lime-stone and coke. Ammonia is also used in the process as an intermediate carrier catalyst. In soda ash industry, solar salt is used which contains 93-94% sodium chloride (NaCl) as against 98% available in the international market. Similarly, the quality of lime stone does not meet the International standard. As regards coke, the industry has no option, but to import it from countries like China, Japan, *etc.*

Coal is not a raw material for soda ash manufacture, but all soda ash units mostly have coal-based captive power plants for cogeneration of steam and power required for the process. In India out of six soda ash manufacturing units, four are based on Solvay process and 91.2% soda ash is produced by this process. Though some soda ash units have imported technology, a few of the Indian soda ash units are capable of designing and engineering soda ash plants. All the manufacturing units in India are producing soda ash of BIS grade.

3.1.2 Present industry dynamics

The industrial structure and characteristics would help us to understand the real impact. There are five main producers of soda ash in India viz. TCL, GHCL, DCW Limited, Nirma & Tuticorin Alkalies (TAFCL) and competition is mainly on the basis of price. India has the advantage of abundance of raw materials viz. limestone and salt, energy-efficient technological plants and growing domestic demand. However, Indian players are facing problems of comparatively higher electricity costs, lack of port infrastructure and higher local taxes.

3.1.3 Uses in industrial sectors

Soda ash is a type of chemical commodity used in several branches of industry. The main ones are quoted in the following paragraphs.

- **Glass industry:** Soda ash is used in manufacturing of flat and container glass. Acting as a network modifier or fluxing agent, it lowers the melting temperature of sand and therefore reduces energy consumption.
- **Detergent industry:** Soda ash is used in a large number of prepared domestic products: soaps, scouring powders, soaking and washing powders containing varying proportions of sodium carbonate, where the soda ash acts primarily as a builder or water softener.
- **Steel industry:** Soda ash is used as a flux, a desulfuriser, dephosphoriser and denitrider.
- **Non-ferrous metallurgy industry**
 - treatment of uranium ores
 - oxidizing calcination of chrome ore
 - lead recycling from discarded batteries
 - recycling of zinc, aluminum
- **Chemical industry:** Soda ash is used in a large number of chemical reactions to produce organic or inorganic compounds, which are used in different applications.
- Sodium bicarbonate



Soda ash Industry

- animal feed to balance their diets for compensating seasonal variations and for meeting specific biological and rearing needs
 - paper industry for paper sizing
 - plastic foaming
 - water treatment
 - leather treatment
 - flue gas treatment, especially in incinerators
 - detergent and cleaning products such as washing powders and liquids, dishwashing products, *etc*
 - drilling mud to improve fluidity
 - fire extinguisher powder
 - human food products and domestic uses: baking soda, effervescent drinks, toothpaste, fruit cleaning, and personal hygiene, *etc*,
 - pharmaceutical applications: effervescent tablets, haemodialysis
- **Sodium sesquicarbonate [Na₃H(CO₃)₂]:** used as bath salts, water softener
 - **Chemically pure sodium carbonate:** used in pharmaceuticals industry, cosmetics, food industry and fine chemicals
 - **Sodium bichromate:** used as cooling systems, corrosion inhibitors, mineral leather tanning agents in industries like machinery manufacturing and repair, corrosion inhibitors, leather, and pesticides *etc*.
 - **Sodium per carbonate:** used as bleaching agent for various fabrics and a constituent for domestic detergent powders and cosmetology
 - Sodium phosphates:
 - Sodium phosphates are used as food additives. Sodium phosphates are added to many foods as an emulsifier to prevent oil separation. Some examples are processed cheese, processed meat, ready-made meal and tinned (canned) soups. Sodium phosphates are also commonly added to powdered soups, and gravy mixtures.
 - Sodium phosphates can also be used as a leavening agent. Some examples of these foods include batter coating on breaded fish or chicken, and commercially baked cakes. Adding sodium phosphates to food increases the shelf life of the food; and also helps in maintaining the texture and appearance of the food. Sodium Phosphate (trisodium phosphate) is also an ingredient of cleaning products; *e.g.*, Sugar soap
 - Sodium silicates: Sodium silicate powder is a water-soluble silicate, generally assumed as a combination of alkali metal oxide, silica and water. It is widely used in basic chemical material form. Some of its uses are as under:
 - used in soap industry
 - used in detergent industry
 - used as anti-oil agent, filling agent and corrosion buffer
 - used as binder and high temperature filling agent
 - as utilised refractory
 - used as the filling-hole material and to strengthen material
 - used to strengthen the force character and durability for cement as fast-drying material
 - natural gas exploitation
 - utilised in oil-exploitation

- used in chemical industry as flame retardant agent, emulsifier, and anti-rust agent.
- used in light industry as ceramic adhesive, ingredient in electric welding rod.
- used as the application scope of liquid sodium silicate
- Sodium sulfites: Sodium sulfite is primarily used in the pulp and paper industry. It is used in water treatment as an oxygen scavenger agent, in photographic industry to protect developer solutions from oxidation and (as hypo clear solution) to wash fixer (sodium thiosulfate) from film and photo-paper emulsions, in the textile industry as a bleaching agent, desulfurising and dechlorinating agent, and in leather trade for sulfitation of tanning extracts. It is used in the purification of TNT for military use. It is used in chemical manufacturing as a sulfonation and sulfomethylation agent. It is used in the production of sodium thiosulfate. It is used in other applications, including froth flotation of ores, oil recovery, food preservatives, and in making dyes.
- Other applications:
 - production of various chemical fertilisers
 - production of artificial sodium bentonites or activated bentonites
 - manufacture of synthetic detergents
 - organic and inorganic coloring industry
 - enameling industry
 - petroleum industry
 - fats, glue and gelatine industry, *etc.*

3.2 Scientific Aspects

Soda ash is the common name given for the technical grade anhydrous sodium carbonate (Na_2CO_3). In the eighteenth century soda ash was produced by LeBlanc process based on roasting salt cake with carbon and limestone. The synthetic process for manufacture of soda ash by ammonia soda process was developed by Ernest Solvay in 1861. Natural deposits of soda containing sodium carbonate (known as Trona) are mostly found in America, East Africa, Mexico and China. About 30% of world soda ash production (90% of this is in U.S. alone) is from natural deposits and the rest 70% is developed from synthetic process.

Soda ash is a white, finely crystalline hygroscopic powder. When freshly packed, contains at least 98.5% Na_2CO_3 . It absorbs moisture and carbon dioxide (CO_2) from the atmosphere during storage and transit. Soda ash is available in four standard forms as light, medium, dense and granular according to the bulk density to suit various industrial requirements.

Soda ash is moderately soluble in water and the solution is strongly alkaline. Although it is low in toxicity, its ingestion could be harmful. Product dust may cause irritation of eyes, nose, throat and lungs. Packing of soda ash is generally done in 75 kilogram (kg) and 50 kg gunny bags and storing is done inside a godown on concrete or wooden floor. It should not be stacked more than 15 ft high. The main consuming industries of soda ash are glass, detergent, laundry soap, sodium silicate, cotton yarn, dyes and dye stuff, paper board and other chemical industries.

For countries which do not possess natural resources of soda ash, the following synthetic processes are available:

- Le Blanc Process
- Solvay Process

- Akzo Dry Lime Process (modification of Solvay process)
- Dual Process (modification of Solvay process)

3.2.1 Raw materials

The raw materials and utility consumption by different process routes are as follows:

- Brine
- Limestone
- Carbon for the lime kiln
- Ammonia
- Additives

3.2.1.1 Brine

Sodium chloride (NaCl or common salt) is extracted by solution mining from underground deposits, which are formed during the geological periods (mesozoic and cenozoic ages) by evaporation of sea water.

In the Solvay process, NaCl reacts in liquid phase. This is known as brine, which contains as much NaCl as possible and is virtually saturated. Brine also contains unwelcome impurities, mainly magnesium, calcium, sulfates, etc.

In several cases mother liquor from salt production process can be used as raw material to partially replace brine when the mother liquor has a suitable composition for the soda ash process.

3.2.1.2 Limestone

Limestone deposits originate from calcareous shell and skeletons of biota as well as chemical and bio-chemical precipitation in the sea during geological ages (mesozoic).

Basically, a high content of CaCO₃ in the limestone is an important parameter to avoid difficulties related to the limestone calcination and improves production efficiency. The cost to transport the inert part of the limestone from the quarry to the plant is also minimised. A limestone rich in CaCO₃ will not only reduce solid matters in the effluent of the distillation unit, but will also, for those soda ash plants that have settling, reduce the volume of solids to be treated.

Particle size distribution of the limestone from quarries is generally between 40 and 200 mm. The more homogeneous it is, the better the lime kiln will work, but greater the amount of limestone fine by-product produced at the quarry.

3.2.1.3 Carbon for the lime kiln

Coke, and rarely coal are used in lime kilns for soda ash production due to the necessity to obtain the highest CO₂ concentration. Other type of fuels, natural gas or fuel oil, would result in a too low CO₂ concentration in the kiln gas. This is important because the kiln gas is used further in the process for its CO₂ contents. Higher CO₂ concentration enables reduction of the equipment size and ammonia losses.

The particle size distribution of the solid fuel has to be appropriate in order to get a homogeneous distribution within the kiln.

3.2.1.4 Ammonia

The Solvay process for soda ash requires an input of ammonia to compensate for the inherent losses from the process. The input is generally carried out as aqueous ammonia solution (10 to 35%), or direct injection of anhydrous gaseous ammonia or by the use of aqueous solution of ammonium bisulfide. Ammonia addition may also be achieved by the use of ammoniacal liquor from coal gas plants.

3.2.1.5 Miscellaneous additives

In addition to the major raw materials there are a number of miscellaneous raw materials, which may be added to the process for their various physical attributes: compounds to aid gas absorption, compounds to avoid scaling, corrosion inhibitors, and settling aids. These all may have minor potential environmental impact.

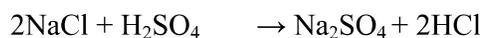
3.2.2 Industrial Processes

3.2.2.1 LeBlanc process

This process was invented by Nicolas LeBlanc, in 1775. Along with several others, LeBlanc had submitted an outline of a process for making soda ash from common salt, in response to an offer of reward by the French Academy in Paris. LeBlanc's proposal was accepted as it was workable on a commercial scale.

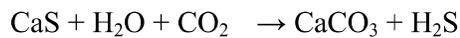
Process description

Reactions



A mixture of equivalent quantities of salt and concentrated sulphuric acid is heated in cast iron salt cake furnace. Hydrochloric acid (HCL) gas is given off and sodium hydrogen sulphate is formed. The gas is dissolved in water and the mixture is raked and transferred to the muffle bed reverbratory furnace where it is subjected to stronger heat. Here sodium sulphate called salt cake is formed.

The cake is broken, mixed with coke and limestone and charged into black ash furnace. The mass is heated and a porous grey mass of black ash is withdrawn. The black ash is leached with water in the absence of air in a series of tanks. The extract containing sodium carbonate, sodium hydroxide and many other impurities, is sprayed from the top of a tower, counter-current to the flow of hot gases from the black ash furnace. This converts sodium hydroxide, aluminate, silicate, cyanate to sodium carbonate. The liquor is concentrated in open pans until the solution is concentrated enough to precipitate sodium carbonate on cooling. The product is calcined to get crude soda ash, which is purified by recrystallisation. The liquor remaining after removal of first crop of soda crystals is purified to remove iron and causticised with lime to produce caustic soda. The mud remaining in the leaching tanks containing calcium sulphide is suspended in water and lime kiln gas is passed through it. The following reaction occurs.



The lean gas containing hydrogen sulphide is passed through another tank obtaining suspension of calcium sulphide.



This solution is again treated with lime kiln gas liberating a gas rich in hydrogen sulphide.



The hydrogen sulphide is burnt in limited supply of air in a special furnace in presence of hydrated iron oxide as a catalyst to obtain sulphur.



The sulphur is sublimed and collected.

3.2.2.2 Solvay process

Solvay process is also known as ammonia soda process, uses salt (NaCl) and limestone (CaCO₃) as raw materials. Ammonia used in the process is almost totally regenerated and recycled. The main advantage of this process is the availability of the raw materials, which can be found almost everywhere in the world and therefore allows operation of production units in proximity to the market.

The Solvay process produces “light soda ash”, with a specific weight or pouring density of about 500 kg/m³. It is used in that form mainly for the detergent market and certain chemical intermediates.

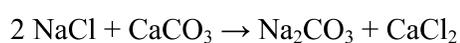
Light soda ash is transformed by recrystallization firstly to sodium carbonate monohydrate, and finally to dense soda ash after drying (dehydration). Dense soda ash has a pouring density of about 1000 kg/m³. It is used mainly in the glass industry. Dense soda ash can also be produced by compaction.

Some producers have made several modifications to the original process. The main ones are:

- Dual process, which allows production units to co-produce nearly equal quantities of ammonium chloride, which may be used as a fertilizer in rice cultivation. There are several plants in the world which are working with that process. Most are situated in China
- Akzo or dry lime process, which uses dry lime instead of lime milk for ammonia recovery

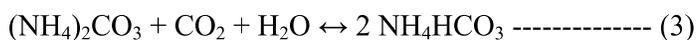
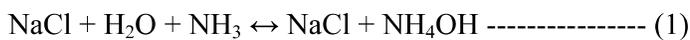
(i) Main chemical reactions

Solvay process for production of soda ash could be summarised by the theoretical global equation involving the two main components: sodium chloride and calcium carbonate.

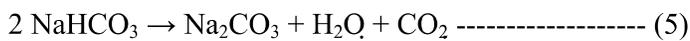


In practice, this direct way is not possible and it needs the participation of other substances and many different process steps to get the final product as soda ash.

First reactions occur in brine. First of all, ammonia is absorbed (1) and then, the ammoniated brine is reacted with carbon dioxide to form successive intermediate compounds: ammonium carbonate (2) then ammonium bicarbonate (3). By continuing carbon dioxide injection and cooling the solution, precipitation of sodium bicarbonate is achieved and ammonium chloride is formed (4). Chemical reactions relative to different steps of the process are written below:



Sodium bicarbonate crystals are separated from the mother liquor by filtration, then sodium bicarbonate is decomposed thermally into sodium carbonate, water and carbon dioxide (5).

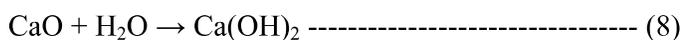


CO₂ is recovered in the carbonation step (see equations 2 and 3 above). CO₂ recovery cycle is shown in Figure 3-1. Mother liquor is treated to recover ammonia. The ammonium chloride filtrate (4) is reacted with alkali, generally milk of lime (6), followed by steam stripping to recover free gaseous ammonia:

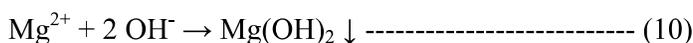


NH₃ is recycled to the absorption step (see equation 1 above). Ammonia recovery cycle is shown in Figure 3-1.

Carbon dioxide and calcium hydroxide originate from limestone calcination (7) followed by calcium oxide hydration (8).



Brine has to be treated before the input in the process to remove impurities: calcium and magnesium. If not removed they would react with alkali and carbon dioxide to produce insoluble salts contributing to scale formation inside equipment. Brine purification reactions are described in the following equations:



Sodium carbonate formed (equation 5) is called light soda ash because its bulk density is approximately 0.5 t/m³. A subsequent operation called densification enables this value to be doubled by crystallization into sodium monohydrate, by adding water (equation 11) then followed by drying (equation 12). Final product is dense soda.

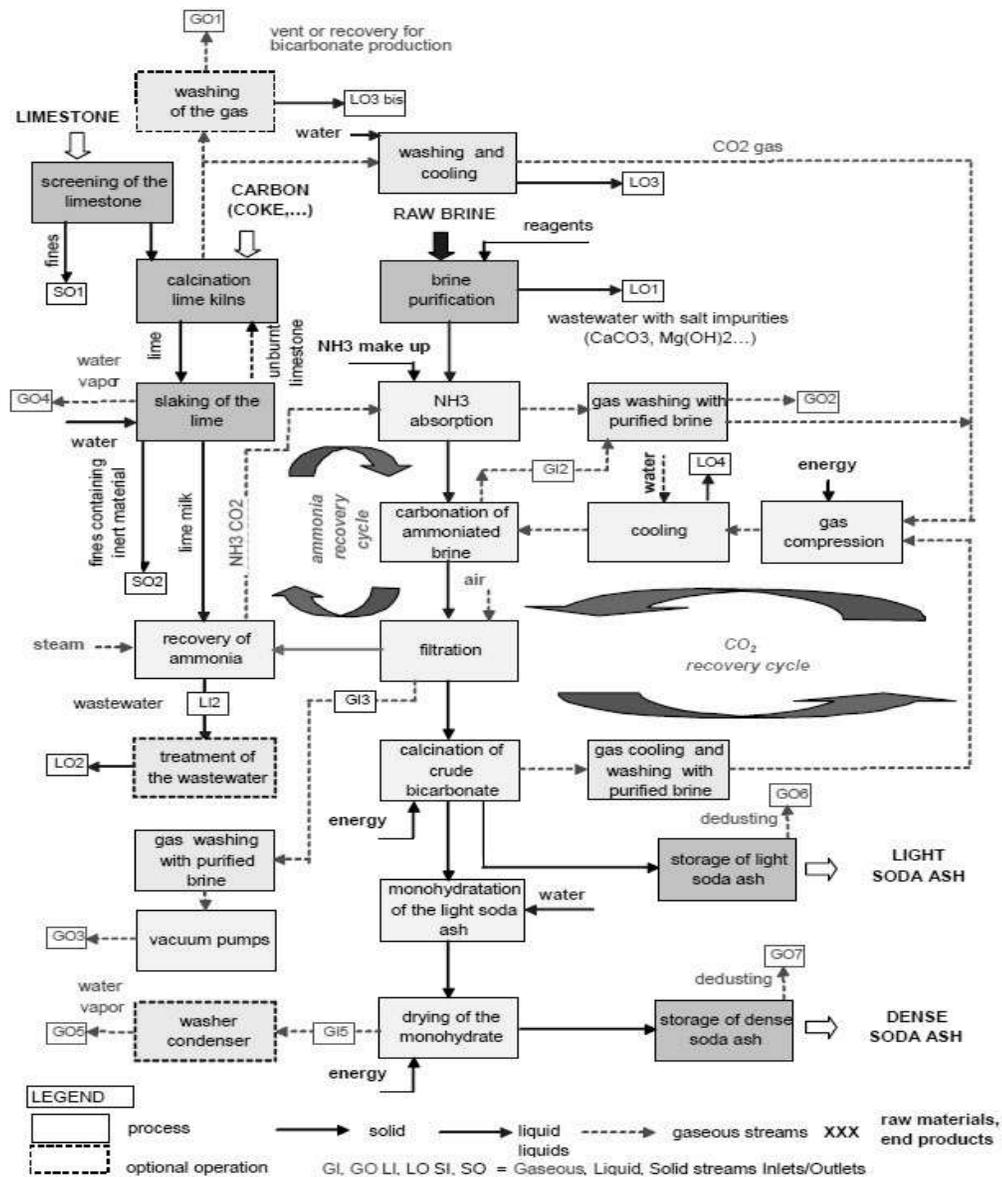
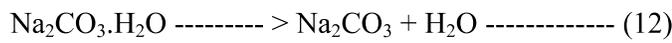
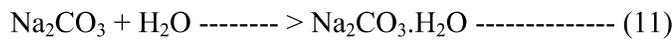


Figure 3-1: Process Block Diagram for the Manufacture of Soda Ash by the Solvay Process

(ii) Unit operations

The usual names of the plant area where the main process operations are taking place are given in Table 3-1.

Table 3-1: Plant Area/Operations

Area	Operation	Process reaction
Brine purification	Brine preparation	9,10
Lime kilns and slaker (dissolver)	Limestone calcination and milk of lime reduction	7,8

Area	Operation	Process reaction
Absorption	Absorption of ammonia	1
Columns (Carbonation Towers)	Precipitation of NaHCO_3	2,3,4
Filtration	Separation of NaHCO_3 crystals from mother liquor	
Calcination	Decomposition of NaHCO_3 to Na_2CO_3	5
Distillation	Recovery of ammonia	6
Densification	Production of dense soda ash	11,12

(a) Brine purification

Impurities such as calcium and magnesium have to be removed from brine. This operation is achieved in the brine purification area.

Magnesium ions, Mg^{2+} , are precipitated as insoluble magnesium hydroxide, $\text{Mg}(\text{OH})_2$, by the addition of an alkaline reagent. The most commonly used reagent is milk of lime as this is already produced in large quantity from ammonia recovery. Another possibility is the use of sodium hydroxide (NaOH).

Calcium ions, Ca^{2+} are precipitated as insoluble calcium carbonate, CaCO_3 , by reaction with sodium carbonate. Depending upon the purification process used to remove sulfate and magnesium contents, a certain amount of calcium can be precipitated as gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Addition of these two reagents is regulated in such a way as to reach the necessary reagent excesses for adequate purification. A sufficient reaction time of the suspension that contains suspended CaCO_3 and $\text{Mg}(\text{OH})_2$ ensures a correct crystallization of the two components. Thereafter the separation of $\text{Mg}(\text{OH})_2$ and CaCO_3 from the purified brine is usually achieved in a decanter or brine settler. The decanter has to be purged frequently.

(b) Lime kilns and milk of lime production

Theoretically, in the soda ash process, the CO_2 balance is stoichiometrically neutral. However, a CO_2 excess is needed to compensate the incomplete absorption of CO_2 in the carbonation stage in the different washers (streams GO_2 and GO_3) and losses in the treatment of the mother liquid in the distillation. This excess is generated by combustion of normally coke, which provides an energy source used for limestone decomposition, as well as the additional CO_2 .

Burning of the limestone (natural form of CaCO_3) is carried out in a temperature range of 950°C to 1100°C . The operating conditions for a lime kiln fitted to soda ash production are critically different from those used for lime production, because of the need to produce a gas with the maximum concentration of carbon dioxide for its subsequent use in the process. This is done to the detriment of produced lime purity, which will be less than that necessary in the lime industry. To improve particle sizing of limestone loaded in lime kiln, screening is sometimes carried out prior to kiln charging

In case of soda ash plants, considering the quantities of limestone to be burned and the necessary CO_2 concentration, the energy contribution is generally provided by means of solid high carbon fuels such as coke, coal or lignite. Use of gaseous fuel leads to too low

CO₂ concentration in the gas produced making its subsequent use impossible without an expensive reconcentration unit.

Raw burnt lime produced by lime kilns associated with a soda ash plant contains approximately 75 to 90% of CaO. Its direct use in the solid form is uncommon because of the difficulty in controlling an adequate feed rate of a material in which the active constituent, CaO, is not constant. By hydrating the CaO to milk of lime a better control of the alkali addition is achieved during the ammonia recovery step.

Hydration of the raw lime is carried out in slakers (dissolvers) where raw lime and water flows are regulated to ensure that the alkali content of milk of lime produced is as constant as possible. This reaction is highly exothermic. A part of the heat generated vaporises some water, which is released from the slaker vent (GO₄). During hydration, fine inert materials contained in limestone (sulfates, silica, clay, silico-alumina compounds, unburned limestone and others) can mainly be found in milk of lime. Larger particles are separated by screening, then washed and recycled or released out of the process. The unburnt pieces of limestone are recycled.

(c) Absorption of ammonia

Ammonia is recovered by recycling the outlet gas from the distillation plant to the absorption stage where it is absorbed in purified brine. This flow mainly contains recovered NH₃ and a quantity of CO₂. This chemical operation is achieved in equipment that allows close gas/liquid contact.

Because this is an exothermic reaction, cooling of the liquid is necessary during the operation to maintain efficiency. The outlet solution, with a controlled ammonia concentration, is called ammoniacal brine. Any gas that is not absorbed is sent to washer where it is contacted with purified brine to remove traces of ammonia before it is recycled or released to the atmosphere.

(d) Precipitation of sodium bicarbonate

Ammoniacal brine is progressively CO₂ enriched (carbonated) with recycled carbon dioxide from sodium bicarbonate calcination and carbon dioxide originating from lime kilns. To ensure adequate CO₂ absorption and sodium bicarbonate precipitation, the ammoniacal brine is cooled with water. Suspension of crystals exiting from columns or carbonators is sent to the filters.

Outlet gas from the carbonation towers is sent to a final washer, contacted with purified brine to absorb NH₃ traces still present in the gas before released to the atmosphere. These may be separate or combined washers with waste gas from the absorber vacuum system

(e) Separation of sodium bicarbonate from mother liquor

Separation of sodium bicarbonate crystals from mother liquor is achieved by means of centrifuges or vacuum filters. After washing of cake to eliminate mother liquor chloride, it is sent to calcination. In liquid phase, mother liquor is sent to the distillation sector for ammonia recovery.

Where filters are used, air is pulled through the cake by means of vacuum pumps. Thereafter, this gas carrying ammonia and some CO₂ is cleaned by a washer fed with purified brine before exhausting to atmosphere.



Crude sodium bicarbonate manufactured by the carbonation process is the primary output of the Solvay ammonia soda process. The bicarbonate produced in this way is the feed to the calcination stage, for conversion to the finished product—solid soda ash. In some cases, a small part of this crude bicarbonate (predominantly sodium bicarbonate) also contains a mixture of different salts like ammonium bicarbonate and sodium chloride. This resultant crude product (after drying) from Solvay process using crude sodium bicarbonate, may find applications in some commercial outlets. However, since any drying gases produced by this simple process are handled in combination with gases from the Solvay ammonia soda ash process and common abatement technology is applied, this process is not described in any more detail. Crude bicarbonate is not to be confused with refined sodium bicarbonate, which is a purified product manufactured according to the process

(f) Sodium bicarbonate calcination

Sodium bicarbonate cake is heated (160 to 230°C) to achieve calcination into a solid phase (light soda ash) and a gaseous phase containing CO₂, NH₃ and H₂O.

This gas is cooled to condense water and the condensates formed are sent to distillation for NH₃ recovery, either directly or via filter wash water. After cleaning, the gas (high CO₂ concentration) is compressed and sent back to the carbonation columns (CO₂ recovery cycle).

Normally, energy needed for sodium bicarbonate calcination is provided by steam that condenses in a tubular heat exchanger, which rotates through the sodium bicarbonate. The method consisting of heating externally by gas or fuel oil combustion in a rotating drum containing sodium bicarbonate is occasionally encountered.

(g) Ammonia recovery

One of the major achievements of the Solvay process is the high efficiency of the ammonia recycle loop. This loop circulates roughly 500 to 550 kg NH₃ per tonne of soda ash from which the ammonia loss is less than 0.5 % of this flow rate. The purpose of this important distillation process is to recover ammonia from the ammonium chloride containing mother liquors recovered from the bicarbonate filters/centrifuges.

After pre-heating with outlet gas from the distiller, supported by the injection of steam at the bottom of the NH₃ stripping column, the mother liquor releases almost all its CO₂ content. Addition of alkali normally in the form of milk of lime decomposes ammonium chloride (NH₄Cl) into NH₃ which is stripped from the solution by injected low pressure steam at the bottom of the distillation column. The outlet solution contains calcium chloride together with all the residual solid materials. Ammonia recovery yield is controlled according to the permitted ammonia concentration in the released liquid. Lower the permitted value, the higher would be the quantity of stripping steam and therefore, lower global energy consumption, and higher cost of the ammonia recovery. This control can only be applied to a theoretical minimum ammonia level.

After cooling and condensation of steam, the gaseous phase containing recovered CO₂ and NH₃ is returned to the absorption area for reuse.

The liquid phase coming out from distillation unit contains – unreacted sodium chloride is not complete due to thermodynamic and kinetic limitations), calcium chloride resulting from reaction with NH₄Cl, solid matter that is derived primarily from the original limestone and finally, small quantity in excess of lime that can ensure a total

decomposition of NH_4Cl . This liquid called DS-liquid or Distiller Blowoff (DBO) will be treated in different ways depending on the particular site and processes used. Clear liquid from DS-liquid can be further used for calcium chloride production, prepared as a concentrated solution or an anhydrous or partially hydrated solid.

(h) Product storage and handling

Soda ash has to be stored in a dry place to avoid hydration, formation of crusts or hardening. Precautions to be taken to prevent contamination by other nearby stored products, and to prevent the release of soda ash dust during handling.

Most of the time, sodium carbonate is stored in large capacity metallic or concrete silos. Because of high daily production in large production units (1000 t/day or more), the available total storage volume is normally less than a week production.

Bulk handling of dense soda ash is easily achieved, for example, by belt conveyor. Necessary precautions have to be taken to avoid and control dust release. Handling methods are selected to minimise any particle size reduction of the product.

(iii) Advantages of Solvay process

- Can use low-grade brine
- Less electric power
- Less corrosion problems
- No co-products to dispose off
- Does not require ammonia plant investment

(iv) Disadvantages of Solvay process

- Higher salt consumption
- Higher investment in ammonia recovery unit versus crystallisation units for ammonium chloride
- Waste disposal of calcium chloride brine stream
- More steam consumption
- Higher capacity plant for economic break-even operation
- With current fertiliser shortage, all of the ammonium chloride will be used as a mixed chemical fertilizer ingredient, so co-product disposal no problem

3.2.2.3 Akzo dry lime process

Akzo dry lime process is a modification of the conventional Solvay process to the extent that milk of lime slurry is not prepared and the heat of hydration of lime and of chemical reaction are sufficient to raise mother liquor to the boiling temperature, thereby reducing the steam and lime consumption in distillation process as compared to Solvay process.

3.2.2.4 Dual process

In dual process, ammonia recovery unit and milk of lime section are replaced with an ammonium chloride section, where ammonium chloride is crystallized and recovered. In this process ammonium chloride is produced as a co-product in equivalent quantities and differs from the conventional Solvay process as it does not recycle ammonia.

Process description

The mother liquor from the carbonating system, containing ammonium chloride, unreacted salt and traces of carbonate is ammoniated in ammonia absorber. The ammoniated mother liquor is passed through a bed of salt in a salt dissolver. Exit liquor from the dissolver, saturated with salt, is gradually cooled from 40oC to 10oC by evaporation under vacuum to separate ammonium chloride. The slurry containing ammonium chloride is centrifuged and dried. The product is 98% pure and is marked as ammonium chloride fertilizer with nitrogen content of 25%.

The mother liquor obtained after the separation of ammonium chloride crystals is recycled to the carbonation vessels placed in series. Carbon dioxide obtained from ammonia plant and the calciner section of soda ash plant is injected in the carbonation vessels. There is a provision of cooling coils in the lower carbonation vessels. Sodium bicarbonate is formed. The growth of crystals, of sodium bicarbonate is controlled by the supply of cooling water to cool coils in carbonation vessels.

Sodium bicarbonate is concentrated in a thickener and centrifuged. The sodium bicarbonate is calcined to soda ash.

The plant has several advantages over the conventional Solvay process. It uses less raw material, has no effluent disposal problem, and both sodium and chloride radical of salt are fully utilized giving valuable ammonium as a by-product.

3.2.3 Co-products

The manufacturing of soda ash by Solvay process enables production of two main co-products — calcium chloride, ammonium chloride — along with the main product, refined sodium bicarbonate.

Raw material consumption per ton of co-product is given in Table 3-2.

Table 3-2: Raw material consumption per ton of co-product

Raw material	Consumption per ton
Salt	1.3 tons
Ammonia	335 kg
Power	250 kwh
Fuel oil:	18 litres
Steam (including refrigeration)	5.2 tons

3.2.3.1 Calcium chloride

Relatively a few synthetic soda ash plants recover calcium chloride, and most of those that do utilize only a small part of the total amount available in the distiller waste. To produce calcium chloride, the distiller waste liquor is settled and then evaporated in multiple effect evaporators (MEE). During concentration, most of the NaCl is separated. The remaining solution is further concentrated to the equivalent of $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$. This solution is cooled, forming flakes which are dried in a rotary dryer giving a product, sold as 77-80% calcium chloride. A small amount is processed to the anhydrous state.

Calcium chloride is used on unpaved roads as a dust abater and as a deicer (defroster) on highways in winter. It is used for freeze-proofing and dust-proofing coal and coke, and in refrigeration brines as a drying agent, and in cement products.

3.2.3.2 Ammonium chloride

Ammonium chloride is the principal salt present in the mother liquor from the crude sodium bicarbonate filtration in the ammonia–soda process. Small amounts have been produced in soda ash plants by carbonation of the filter liquor, concentration, and crystallization of the ammonium chloride. Most of the demands in the United States are of low tonnage. The end uses are primarily in dry cells and fluxing agents.

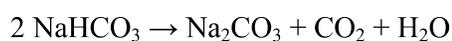
However, ammonium chloride is also a good fertilizer for important crops in rainy climates, particularly for rice. In Japan, the production of ammonium chloride as a by-product is quite large. In one of the process for manufacturing large quantities of by-product of ammonium chloride, more ammonia is first added to the filter liquor, which is chilled to approximately 10°C. Solid NaCl is added, dissolved, and an ammonium chloride precipitates, which is separated for sale, the mother liquor being recycled to the carbonation operation. There are significant differences in equipment of the conventional ammonia soda process and the ammonium chloride producing soda ash process. For example, there is no ammonia recovery and therefore no distillation tower, likewise, no milk of lime and consequently no lime kilns which are also the source of CO₂ for bicarbonation. However, the ammonium chloride producing process requires, unlike the regular ammonia – soda plant, equipment to process solid salt, and of the ammonium chloride production, crystallizers, filters, dryers, and cooling equipment of corrosion resistant materials. In addition, an ammonia source is required which preferably supplies carbon dioxide also for the bicarbonation.

3.2.3.3 Refined sodium bicarbonate

Refined sodium bicarbonate is mostly produced from a solution of sodium carbonate that may also contain small amounts of dissolved sodium bicarbonate. This solution can be prepared following two ways.

- The first consists of dissolving soda ash in water.
- In the second, the solution is the result of the thermal decomposition of crude sodium bicarbonate from the filtration step of the soda ash process after being suspended in a soda ash solution.

In the latter case, the thermal decomposition reaction is as follows:



The CO₂ produced by this reaction is totally recovered in the soda ash process by mixing with the outlet gas from calcination of crude sodium bicarbonate.

The prepared sodium carbonate solution is sent to a bicarbonation tower where CO₂ is blown until precipitation of sodium bicarbonate occurs. This crystallisation (precipitation) after dissolution ensures the purity of the product.



If refined sodium bicarbonate unit is linked to a soda ash plant, the CO₂ gas is sourced from the lime kiln gas excess. The quantity of CO₂ fixed in the carbonation reaction represents a net additional consumption of CO₂, removed from the quantity otherwise vented.

The bicarbonate is separated from the mother liquor by filtration/centrifugation. The mother liquor is recycled upstream by the preparation of sodium carbonate solution. The purge from the recycle loop may be used as a carbonate source. In case of a soda ash plant, it could be sent to the brine purification area. The bicarbonate cake from separation is dried (e.g. by hot gas), sieved, graded, stored and sold as bagged or bulk product.

Different grades of refined sodium bicarbonate, differentiated by their properties (particle size distribution, purity, etc) are sold to the market according to the final uses of the product e.g. animal feed, food, pharmaceutical or technical applications.

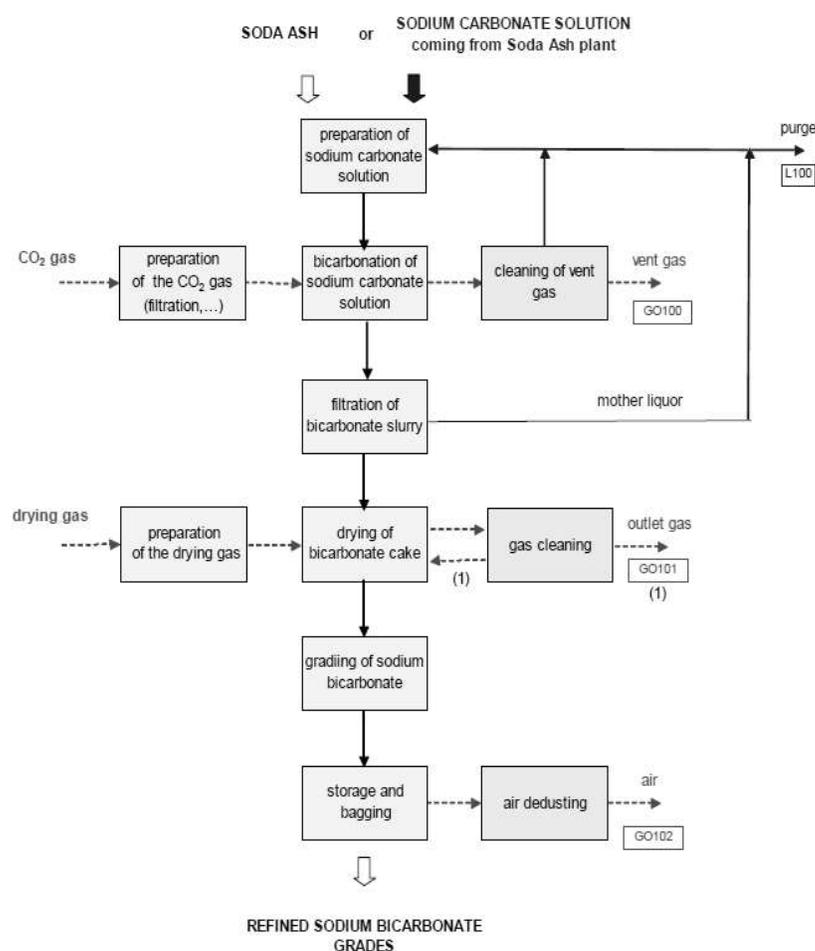


Figure 3-2: Typical Process for the Manufacture of Refined Sodium Bicarbonate

3.3 Quantitative analysis of input and output

3.3.1 Specific raw material consumption and emission factors

Soda Ash industries in India adopt solvay process/modified solvay process to manufacture soda ash for which chemical grade lime stone is one of the major raw materials. Quality of limestone (Chemical grade lime stone) available in India is

restricted and rapidly depleting/deteriorating. Quality of limestone varies from mine to mine in case of indigenous lime stone (CaCO_3 content ranges between 83-93%) or supplier-to-supplier basis in case of imported lime stone. Hence the inert content i.e. TSS varies case to case basis. Further, content of TSS in the effluent also varies with respect to the process of soda ash production i.e. dry process or wet process. The indicative ranges for the major emissions levels of the Solvay soda ash process are given in Table 3-3.

Table 3-3: Major Emissions Levels from Solvay Soda Ash Process

INPUT	
Main raw material	kg/t sodium
Limestone	1050-1600 (inlet lime kiln) 1090-1820 (inlet plant)
Raw brine	NaCl (1530-1800) + water (4500-5200)
NH ₃ make up	0.8-2.1
Water	m³/t soda ash (dense)
Process	2.5-3.6
Cooling	50-100
Energy	GJ/t soda ash (dense)
Fuels (lime kiln)	2.2-2.8
Fuels (soda ash), including electricity	7.5-10.8, 0.18-0.47 (50-130kWh/t soda ash)
OUTPUT	
CO ₂	200-400
CO	4-20
NH ₃	<1.5
Dust	<0.2
Liquid emissions (outlet distillation)	Kg/t soda ash
Cl ⁻	850-1100
Ca ²⁺	340-400
Na ⁺	160-220
SO ₄ ²⁻	1-11
NH ₄ ⁺	0.3-2
Suspended solids	90-700
Solids emissions	Kg/t soda ash
Fines of limestone	30-300
Non recycled grits at slaker	10-120

3.4 Sources of Environmental Pollution

3.4.1 Gaseous emissions

(i) Carbon dioxide and carbon monoxide

During the burning of CaCO_3 to CaO inside the limekilns, CO and CO_2 are produced from the combustion of coke and from the decomposition of limestone. A normal Solvay process needs excess of CO_2 . Some of the excess is required to compensate for non-ideal absorption of CO_2 in the carbonation towers.

Carbonating towers also have an outlet for the discharge of gases that have not reacted in the process. This gas is cleaned with brine in a washer to recover NH_3 and possibly H_2S , if present, and to reintroduce these components back into the process, while CO_2 , CO and other inert gases pass out to atmosphere.

Further, excess CO_2 may be beneficially used in sodium bicarbonate production. Any surplus CO_2 is vented as kiln gas to atmosphere [GO_1]. The amount of CO_2 vented to atmosphere from a stand-alone soda ash process is in the order of 200 to 300 kg CO_2 per tonne of soda ash. The split of losses to atmosphere depends upon the detailed plant configuration.

CO gas is virtually inert through the process. All CO produced must therefore be vented to the atmosphere either at the kilns or through the carbonation tower after gas scrubbers. CO generation is in the order of 4 to 20 kg CO per tonne of soda ash, depending on the conversion of CO into CO_2 (Boudart reaction) during the limestone calcination step.

When released into the atmosphere, the CO is converted by natural processes into CO_2 , which is a gas naturally present in the atmosphere. Furthermore, provided the dispersion of CO and CO_2 is adequate and the stack responds to the normal dispersion rules, no local impact on the environment or health are expected or experienced.

(ii) Nitrogen oxides (NO_x)

NO_x are produced inside the kiln by oxidation of nitrogen during the combustion. Since the temperature inside the kiln is moderate (up to 1100°C), the formation of NO_x is rather limited. Measurements in some plants indicate concentration after washing less than 500 milligram (mg) of NO_x per Nm^3 .

(iii) Sulfur oxides

SO_x are produced by the oxidation of sulphur containing compounds in the limestone and coke. The formation of SO_x is limited due to low sulphur content of fuels used and some auto-purification reactions in the lime kilns. Furthermore, SO_x in the kiln gas sent to the process is absorbed.

(iv) Ammonia

Primary atmospheric emissions containing ammonia originate from the bicarbonate precipitation and filtration stages of the process.

- from precipitation of bicarbonate in carbonation tower after cleaning in tower washers



- from filtration of bicarbonate, after cleaning in filter washers
- in addition, there are a number of diffuse ammonia from the filters, bicarbonate conveyors and from the handling, and processing of the distillation effluent.

Fluctuation in the emissions can be explained by the:

- performance of stripping columns and operating parameters control (height, steam injection, temperature control, monitoring of outlet concentrations)
- disturbances in the mother liquor feed (flow rate, composition)

The emitted gaseous load is on an average of 0.55 kg NH₃/t soda ash, but the spread can be very large, from 0.09 up to a typical range of 0.6 to 1.5 kg NH₃/t soda ash from the production unit, representing a release into the environment of 30 to 750 t/year for a 500 kilotonne (kt)/year soda ash unit.

Typical concentration lies around 30-40 mg/Nm³ but much higher values can be encountered (> 100 mg/Nm³). This wide range has resulted from a number of international variations in regulatory requirements and equipment availability.

Considering the high turnover into the process (550 kg NH₃ / t soda ash), the loss rate of ammonia therefore is very low in the process (generally less than 0.5 %).

Considering the type of release (continuous emission from elevated stack ensuring appropriate dispersion), the very low persistence of ammonia into the atmosphere (in the range of a few days), due to its high solubility in rainwater and its rapid turnover into the ecosystems by biological nitrification/denitrification mechanisms, the local or regional environmental impact burden is to be considered as very low.

(v) Hydrogen sulfide

In some plants H₂S may be added as a corrosion inhibitor, in the form of sodium hydrogen sulfide. Emission sources are from the tower gas washers and H₂S is typically controlled at maximal emission levels of 5 to 15 mg/Nm³.

(vi) Particulate dust

Dust is emitted from soda ash production in limited quantities, arising from the following steps:

- handling of mineral raw materials (coke, limestone) as diffuse sources
- limestone conversion in kilns, but in limited quantities or during abnormal operation since all the gas is collected to a washing cooling step and thereafter is used in the carbonation stage in a liquid solution
- handling of soda ash and densification of light soda ash (hydration and dehydration) to produce dense soda ash
- handling of these products

It is common to use bag filters or wet scrubbers which will significantly reduce the levels of dust emitted to atmosphere. The dust emitted is around 0.10-0.15 kg of dust/t soda ash, and represents a typical quantity of 50-75 t/year.

The composition of the dust reflects the composition of material handled, namely:

- C from coke
- CaCO_3 , Al_2O_3 and SiO_2 from limestone, sand and clays
- CaO from burnt lime
- Na_2CO_3 and NaHCO_3 from soda ash and sodium bicarbonate production and transport

Most stringent environmental regulations in the Western countries require threshold values of 40 or 50 mg/Nm^3 for atmospheric emission of dust. For instance, in Germany, limits are 50 mg/Nm^3 if the discharge is more than 0.5 kg/h and 150 mg/Nm^3 if the discharge is less than 0.5 kg/h, No maximal load is defined.

Measurements which are made in some plants indicate that more than 75 % of the dust emissions are relatively large particles >10 microns (μ) and that the contribution to PM_{10} is relatively low.

3.4.2 Liquid effluents

The sources of liquid effluent from the soda ash process are typically:

- wastewater from distillation (after treatment)
- wastewater from brine purification
- cooling waters from lime kiln gas washers, cooling in the CO_2 compression loop, cooling of the absorption and distillation towers, calcination (once through or closed circuits)

3.4.2.1 Wastewater from distillation

Flow rates and concentrations for major components present outlet distillation are given in Table 3-4. These indicative ranges represent the effluent from the distiller prior to any form of treatment and should not necessarily be considered as levels or concentrations emitted to the environment.

The size distribution of the suspended solid (SS) particle is typically characterized by an average particle size between 5 and 10 μm , 85% of particles smaller than 50 μm and 100% smaller than 1.25 mm.

It is worth noting that large variations in SS quantity and composition can occur according to the composition of the type of the available limestone.

Table 3-4: Wastewater from distillation

Component	Quantity (kg/t soda ash)	Concentration (kg/m^3 clear liquid)
Clear liquid	9300 - 11800 8.5 – 10.7 (m^3/t soda ash)	
Cl-	850 – 1100	99 – 115
OH-	9 – 30	1 – 2.7
SO_4^{2-}	1 – 11	0.1 – 1.2
Ca^{2+}	340 – 400	39 – 45
Na+	160 – 220	18 – 25

Component	Quantity (kg/t soda ash)	Concentration (kg/m ³ clear liquid)
NH ₄ ⁺	0.3 – 2.0	0.03 – 0.24
Suspended solids	90 – 700	11 – 70
Alkalinity expressed as CaO	7 – 20 – 80	0.7 – 9.0
CaCO ₃	30 – 70 – 110	3.8 – 11
SO ₄ as CaSO ₄	15 – 35 – 90	1.7 – 7.1
Rest (clays, sands, etc.)	by difference	by difference

Note:

(1) Underlined values are typical averages, (2) Determined as total Ca minus Ca in CaSO₄, CaCO₃ and CaCl₂, (3) kg/m³ raw liquid, (4) Figures in this table are indicative ranges of annual averages based on various measurement or estimation techniques.

Some additional low quantities of calcium sulfate (CaSO₄), calcium hydroxide (Ca(OH)₂) and trace elements are also present. Traces of heavy metals originating naturally from raw materials are related to limestone, coke and salt composition; the process in itself does not add heavy metals. Given the alkaline nature of wastewater emissions, metals are — in major part — insoluble and are included as part of SS.

According to its composition, the SS are classified as non-hazardous.

3.4.2.2 Wastewater from brine purification

Wastewater from brine purification is basically brine with suspended precipitated CaCO₃ and Mg(OH)₂ in variable proportions according to the nature of salt deposits (calcium and magnesium ions coming naturally from the original sea water).

These solids (10-70 kg/t soda ash) can be treated separately or can be disposed together with liquid effluent from the distillation unit for solid removal and treatment. Typical concentration is as follows in Table 3-5.

Table 3-5: Effluent from Brine Purification (Typical Composition)

Component	Concentration (% w/w)
CaSO ₄ 2H ₂ O	0 – 8
Mg(OH) ₂	1 – 6
CaCO ₃	5 – 15
Brine	By difference

Note: Figures in this table are indicative ranges of annual averages based on various measurement or estimation techniques

3.4.3 Solid waste

The typical solid wastes produced by the soda ash process are given in Table 3-6.

Table 3-6: Solid effluents from soda ash process

Effluent	Quantity (kg/t soda ash)
Fines of raw limestone from screening	30 – 300
Grits from slaker containing inert material	10 – 120

Note: Figures in this table are indicative ranges of annual averages based on various measurement or estimation techniques.

3.4.3.1 Fines of limestone

After crushing, the limestone is passed through a sieve in order to remove the fine gravel fraction (0-40 mm), which could be a cause of plugging and bad distribution of combustion air in the lime kiln. This may be done at the quarry or, in some cases, at the soda ash plant, if the limestone is too crumbly.

The fines' composition is 85% to 97% CaCO_3 with impurities of sand, clays (as SiO_2 , Al_2O_3) depending on the limestone composition in the deposit.

3.4.3.2 Non-recycled stone grits at slaker

Due to imperfect conversion reaction there will be some under-burnt stones inside the kiln, which are drawn with the lime to the slaker. The coarser unburnt stone can be separated at the slaker and is sent back to the kiln. Unburnt stones of smaller sizes are rejected and a very fine material is suspended in the milk of lime. This is simply passed through the distiller and out in the distiller waste liquid.

The unburnt stone contains most of the impurities and pieces of silica present in the limestone feeding the kiln.

3.5 Control of Pollution from the Industry

3.5.1 Gaseous emissions management

Gaseous emissions are generated in the following main steps of the process:

- calcination of limestone
- precipitation of crude bicarbonate
- filtration of bicarbonate
- storage of light soda and dense soda

(i) Calcination of limestone

The calcination of limestone produces CaO and CO_2 and is designed to maximise the CO_2 content by minimising the presence of oxygen in the outlet gas. A conventional ammonia soda process produces about 30% more CO_2 than theoretically needed and it is necessary to purge some of the CO_2 produced to the atmosphere. If there is an associated sodium bicarbonate plant then this excess gas can be diverted for usage there.

Atmospheric emissions of SO_2 from the lime kilns are low (less than 350 mg/Nm^3) because the concentration of sulphur in the fuel (coke) and the limestone employed is

very low. Small amounts of SO₂ produced tends to be fixed by CaO and CaCO₃ as CaSO₄, producing auto-purification similar to the technique used for boiler flue gas treatment.

Before discharge to the atmosphere, kiln gas may be cleaned and generally cooled at the same time by washing towers.

Alternatively, gas cleaning systems (normally bag filters) can also be used to collect the dust as dry material. If dry cleaning is used, residual material is made of fine particulates containing limestone, lime, organic carbon (coke). This can be collected separately and may be disposed without further treatment. However, this type of gas cleaning is difficult to operate because the lime kiln gas may be too hot for the filtering media (risk of fire).

Typical quantities of CO₂, CO and dust in the gas effluent from lime kilns after cleaning are given in Table 3-7. This excludes the major component which is inert, mainly N₂.

Table 3-7: Vent gas from lime kilns after cleaning

Component	Quantity (kg/t soda ash)
CO ₂	200-300
CO	0-8
Dust	0.1-0.2

Note: (1) Values are significantly lower when a refined sodium bicarbonate plant is operating. (2) Figures in this table are indicative ranges of annual averages based on various measurement or estimation techniques.

(ii) Precipitation of crude sodium bicarbonate

Outlet gas from the carbonation columns is subjected to a cleaning process with brine in a packed or plate washer to recover NH₃ and possibly H₂S and recycle them into the process via the feed brine. Washers may have an optional final water washing section to minimise emissions. This type of equipment has been designed to meet the specific needs of the process and to allow efficient recycle of valuable raw materials.

Typical quantities of CO₂, CO, and NH₃ in the gas from column section after cleaning are given in Table 3-8.

Table 3-8: Vent gas from column section after washing

Component	Quantity (kg/t soda ash)
CO ₂	40-100
CO	4-12
NH ₃	0.01-0.6

Note: Figures in this table are indicative ranges of annual averages based on various measurement or estimation techniques.

(iii) Filtration of bicarbonate

Air containing ammonia from the filtration (vacuum) step of crude sodium bicarbonate undergoes a cleaning process with brine in a washing tower to recover NH₃ and

reintroduce it to the process. The design is normally very similar to that used for scrubbing the gases from carbonation towers. Typical quantities of CO₂ and NH₃ in the filter air after cleaning are given in Table 3-9.

Table 3-9: Typical quantities of CO₂ and NH₃ in the filter air after cleaning

Component	Quantity (kg/t soda ash)
CO ₂	2-4
NH ₃	0.005-0.3

Note: Figures in this table are indicative ranges of annual averages based on various measurement or estimation techniques.

(iv) Production of dense soda ash

Outlet watervapour of dense soda dryers is cleaned with water by means of a packed or spray washer to eliminate soda ash particles in the vapour and recover this soda water for use in the production process. The cleaned vapour stream (GO₅) is a mixture of air and watervapour.

Additional gas cleaning may be required where calcination is carried out in fluid beds rather than steam-heated rotary calciners.

(v) Convey and storage of light and dense soda ash

Storage of light and dense soda ash is achieved in large silos equipped with dedusting systems, which keep the products dry and isolated to prevent dust emission into the atmosphere.

Because of the nature of conveyers, elevators, airlock valves, *etc.*, the soda ash process typically uses a range of high-efficiency bag filters to separate dust from vent gas streams.

3.5.2 Liquid effluent management

Wastewater discharge treatment is environmental aspect in which significant differences arise from one production plant to another.

Apart from cooling water, aqueous emissions of soda ash production plants are characterized by a high concentration of SS and dissolved salts. These solids and salts are unreacted limestone and salts of natural origin.

SS and dissolved salts originate from three different steps of the process

- brine purification
- ammonia recovery
- as a minor contribution, cleaning of CO₂ originating from calcination of limestone

In most production plants, brine purification effluent is discharged jointly with effluent originating from the distillation unit.

The typical composition varies according to raw material quality. However, different treatment schemes are developed according to geographical location of the production plants and the requirements of the local regulatory authorities.

Options available for treatment of these effluents are:

- direct discharge of raw effluent, with or without partial removal of some fraction of the solids, and with or without preliminary pH adjustment
- indirect discharge of wastewater after removal of suspended solids and with or without preliminary pH adjustment
- further treatment to produce by-product such as CaCl_2

(i) Liquid effluent treatment and discharge

According to the location of production plant and raw material deposits, two basic lines are established for the SS treatment – total dispersion and/or separation of the SS and liquid dispersion.

Total dispersion is employed when production plant is close to the sea or high flow rivers. This technique ensures that the solid material is assimilated with the natural sediments of similar composition. Chlorides and other soluble salts present in the liquid fraction are dispersed in a medium which, in the sea case, already has them in large quantities or, as in case of high flow rivers, is able to ensure that water quality is suitable for subsequent uses. With a careful study of environmental aspects and a good selection of the discharge point, it can be ensured that the disposal system has an acceptable impact completely assimilated by the environment.

Deposition/dispersion is generally used where there is no suitable environmental medium to allow for total dispersion. This method involves the physical separation of liquid and solid phases. The liquid phase is then discharged to a local watercourse with or without pH adjustment as appropriate and solids are used to build up the settling basin itself. The underground deposition of the solids is carried out when salt deposits are found near production plants and when deposit characteristics and the salt extraction system enables it.

(ii) Marine outfalls

Soda ash production wastewater containing suspended solids can be discharged directly to the sea or in estuary under tidal influence by means of an open channel or underwater outfalls, designed with necessary environmental, technical and marine ecological studies. The environmental impact is minimal due to the similarity between the chemicals present in the receptor medium and in the discharged material (chloride, sodium, calcium as ions).

In addition to the hydraulic calculations, the marine outfall diffuser design requires a detailed study of the receptor medium to set the coordinates of the discharge point to ensure an adequate dispersion and a minimum impact.

In an environmental impact study, coastal and marine dynamics (bathymetry, currents, physiochemical analysis of water and sediments, *etc.*) and biology (planktons, *etc.*) may be considered and assessed.

With data obtained and the use of transport, dispersion models, the length and the optimum depth of outfall can be determined assuring an impact acceptable to the receiving environment.

(iii) Lake and river discharge

The direct discharge or discharge after preliminary treatment is to be decided after a careful examination of the local conditions of the receiving water and available land and environmental impact assessment.

Direct discharge is practiced when the flow rate of the receiving medium is high when compared to the industrial effluent.

Mixing effluents with either cooling water or with natural waters (river or lake) leads to a natural homogeneous pH adjustment.

(iv) Settling ponds

The clarification by decanting (liquid/solid separation) large quantities of SS in aqueous effluents is usually achieved in settling ponds (also called 'lagoons' or 'dykes').

Fines of limestones or solid particles settled in the basin can be used to build up the walls as the deposit in the basin accumulates. The height of the deposit can reach 25-40 m above ground.

Each basin has a typical width at least 15-25 ha of area for operations, but can be much larger in order to limit the number of alternate settling/drying phases (2-4 times/year).

The aqueous outfall is collected at several points through separators and drainage pipes to a peripheral channel collecting all outfalls of drainage.

The location of settling ponds depends on several factors including – area available for permanent long-term land occupation, distance between factory and final discharge point, underground geological and hydrogeological characteristics and landscape impact.

In case of available alluvial deposits with economical value (gravels or sands), the area can be previously excavated, thereby increasing the volume available for deposition, the excavated material being used for civil engineering.

Zero discharge may be achieved where project involves saltworks facilities in the close vicinity. If one mixes the clear liquor of Soda Ash in the salt brine then the hardness gets affected. The hardness/impurities needs to be controlled

(v) Liquid effluent discharge management

The impact of direct discharge of the liquid waste containing soluble salts in rivers is linked to the flow rate of the receiving rivers, the fluctuations of it and the inherent qualities of the water including its natural salinity.

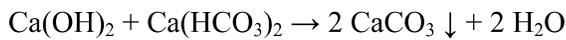
(vi) Adjustment of pH

The typical pH value of raw effluent is higher than 11.5 due to the alkalinity of OH⁻ ions from Ca(OH)₂.

Theoretically, the pH adjustment of such an effluent can be achieved either by mixing in open channels or basins, with natural or raw waters containing dissolved bicarbonate, by reacting with gas containing CO₂ (for example flue gas from power units) in pH

adjustment columns or by other pH adjustment mechanisms if acid solutions or acid wastewaters are available.

In practice, the pH adjustment of soda ash wastewater is usually achieved by mixing with natural water according to the following mechanism:



Wastewater is mixed with available natural water (either cooling waters after use or surface waters—river, channel, lake, sea or underground water, *etc.*) in a typical ratio natural water/wastewater at 5 to 10:1. The CaCO_3 particles thus formed are discharged or settled in ponds, in natural or artificial lakes or in a dedicated channel of the waterway or estuary. Appropriate hydraulic retention time for settling in quiescent waters is usually 6-8 hours. Periodic removal of settled particles is achieved by dredging where the speed of the existing stream is not sufficient to keep the particles in suspension up to settling zones (*e.g.* in the sea). This method offers numerous advantages:

- pH adjustment mechanism is efficient and reliable.
- No consumption of supplementary reactants is needed.
- The settled particles are inert.
- Complex mixing and decanting neither equipment nor instrumentation and monitoring are needed.

(vii) Recovery and reuse of by-products

The by products can recovered from the units are:

- Dissolved CaCl_2 in distillation wastewater
- SS in distillation wastewater
- SS in distillation wastewater

3.5.3 Solid waste management

(i) Limestone fines

Since the composition of the limestone fines it is same as or is closer to raw limestone, this material can be used without any restriction for civil engineering works and filler material for roads, highway, dams, banks and for cement manufacturing. In some existing soda ash factories, it is mainly used for internal purposes (walls of the dikes, roads in quarry operation). Higher specification would require a further separation of gravel and clay material by water washing.

(ii) Grits from slaker

The composition of grits from slaking operation enables recycling of this product to the lime kiln, reuse of it as soil conditioner for pH correction or as filler for concrete.

A milling step is required to adjust the particle size distribution, as fine as possible for soil conditioning or as regular as possible for concrete incorporation.

3.6 Summary of Applicable National Regulations

3.6.1 General description of major statutes

A compilation of legal instruments applicable to the soda ash industry is provided as **Annexure I**.

3.6.2 General standards for discharge of environmental pollutants

General standards are applicable wherever industry-specific standards are not mentioned or notified. General standards for discharge of environmental pollutants as per CPCB are given in Annexure II.

3.6.3 Industry-specific requirements

Table 3-10: Effluent standards

Parameter	Concentration not to exceed		
	Marine	Brackish	Inland surface water
pH	6.5 - 9	6.5 – 9	6.5 – 9
Temperature	450C or less	450C or less	450C or less
Oil & grease	20 mg/l	20 mg/l	10 mg/l
Suspended solids (SS)	500 mg/l	200 mg/l	100 mg/l
Ammonical nitrogen	50 mg/l	50 mg/l	30 mg/l
Bioassay (96 hours)	90% survival	90% survival	90% survival

Note: MINAS for disposal in brackish and inland surface water are without any dilutions.

Table 3-11: Dual Process Soda Ash Plants

Parameter	MINAS (Inland Surface Water)
pH	6.5 - 8.0
Ammonical nitrogen, as N (mg/l)	50
Nitrate nitrogen, as N (mg/l)	10
Cyanide, as CN (mg/l)	0.2
Hexavalent chromium (mg/l)	0.1
Total chromium (mg/l)	2.0
Suspended solids, (mg/l)	100
Oil and grease (mg/l)	10

Note: These standards are to be implemented by the industry in a time targetted schedule by December, 1999. The progress on the time targetted implementation schedule shall be periodically submitted by the industry to the SPCB and the CPCB.

4.

OPERATIONAL ASPECTS OF EIA

Prior environmental clearance process has been revised in the Notification issued on 14th September, 2006, into following four major stages *i.e.*, screening, scoping, public consultation and appraisal. Each stage has certain procedures to be followed. This section deals with all the procedural and technical guidance, for conducting objective-oriented EIA studies, their review and decision-making. Besides, the Notification also classifies projects into Category A, which require prior environmental clearance from MoEF and Category B from SEIAA/UTEIAA.

Consistency with other requirements

- Clearance from other regulatory bodies is not a pre-requisite for obtaining the prior environmental clearance and all such clearances will be treated as parallel statutory requirements.
- Consent for Establishment (CFE) and Prior Environmental Clearance are two different legal requirements, a project proponent should acquire. Therefore, these two activities can be initiated and proceeded with simultaneously.
- If a project falls within the purview of CRZ and EIA Notifications, then the project proponent is required to take separate clearances from the concerned Authorities.
- Rehabilitation and Resettlement (R&R) issues need not be dealt under the EIA Notification as other statutory bodies deal with these issues. However, socio-economic studies may be considered while taking environmental decisions.

4.1 Coverage of the Industry under the Purview of Notification

All new soda ash industrial projects including expansion and modernization require prior environmental clearance. Based on pollution potential, all these projects are classified into Category A

The sequence of steps in the process of prior environmental clearance for Category A projects is shown in Figure 4.1. The timelines indicated against each stage are the maximum permissible time lines set in the Notification for said task. In case the said task is not cleared/objected by the concerned Authority, within the specified time, said task is deemed to be cleared, in accordance to the proposal submitted by the proponent. Each stage in the process of prior environmental clearance for the soda ash industry is discussed in subsequent sections.

In case of Expansion or Modernization of the developmental Activity:

- Any developmental activity, which has an EIA clearance (existing plant), when undergoes expansion or modernization (change in process or technology) with or without increase in production capacity or any change in product mix beyond the list of products cleared in the issued clearance is required to submit new application for EIA clearance.

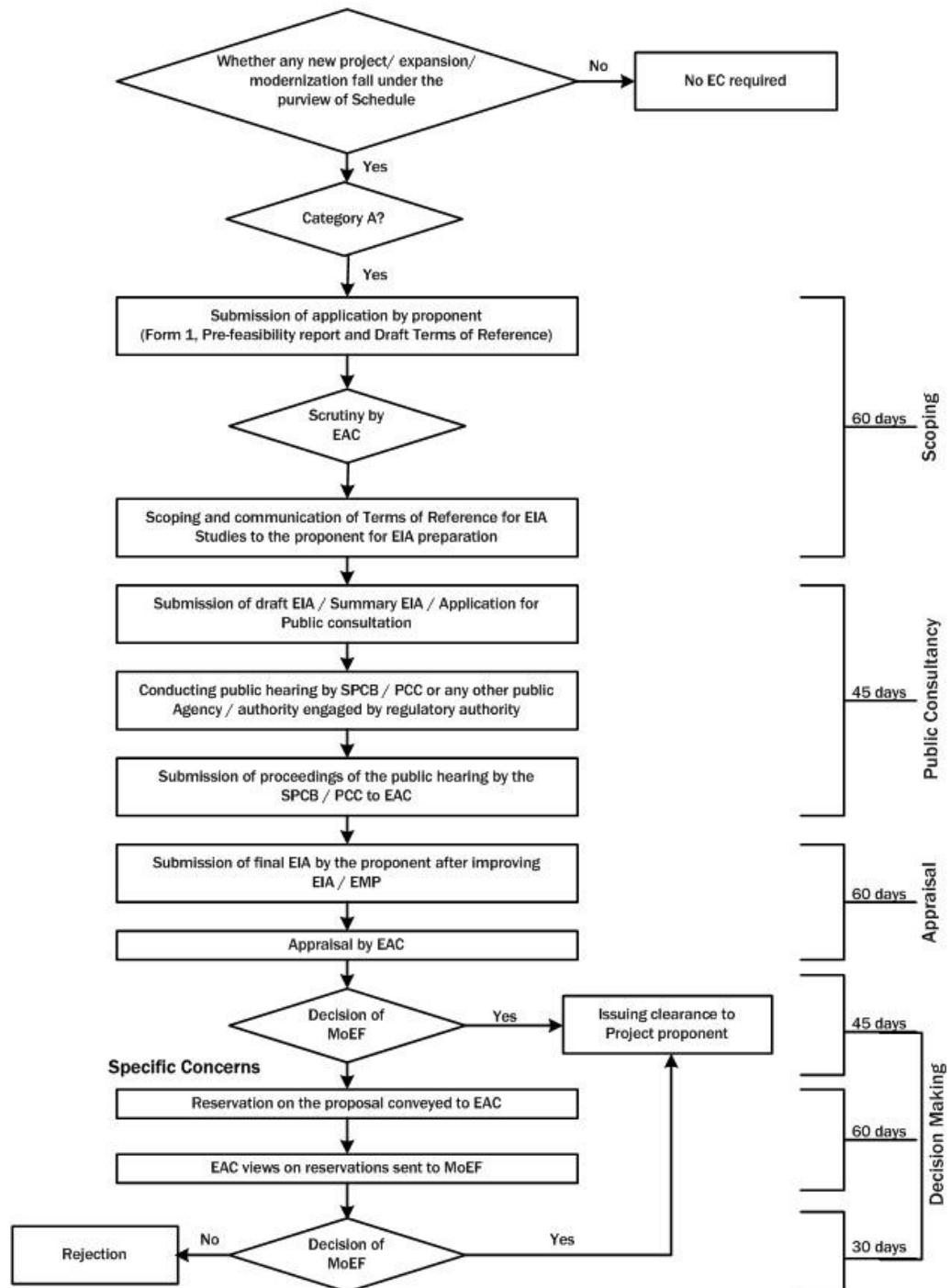


Figure 4-1: Prior Environmental Clearance Process

4.1.1 Application for prior environmental clearance

- The project proponent, after identifying the site and carrying out a pre-feasibility study, is required to apply for the prior environmental clearance using Form 1 given in **Annexure III**. The proponent has to submit the filled in Form 1 along with the pre-feasibility report and draft ToR for EIA studies to the concerned Authority *i.e.* MoEF, Government of India for Category A projects. Please refer subsequent sections for

the information on how to fill the Form 1, contents of pre-feasibility report and draft for sector-specific ToRs.

- Prior environmental clearance is required before starting any construction work, or preparation of land is started on the identified site/project or activity by the project management, except for securing the land.
- If the application is made for a specific developmental activity, which has an inherent area development component as a part of its project proposal and the same project also attracts the construction and area development provisions under 8a and 8b of the Schedule, then the project will be seen as a developmental activity other than 8a and 8b of the Schedule.

4.1.2 Siting guidelines

These are the guidelines, stakeholders may consider while siting the developmental projects, to minimize the associated possible environmental impacts. In some situations, adhering to these guidelines is difficult and unwarranted. Therefore these guidelines may be kept in the background, as far as possible, while taking the decisions.

Areas preferably be avoided

While siting industries, care should be taken to minimize the adverse impact of the industries on immediate neighborhood as well as distant places. Some of the natural life sustaining systems and some specific landuses are sensitive to industrial impacts because of the nature and extent of fragility. With a view to protect such sites, the industries may maintain the following distances, as far as possible, from the specific areas listed:

- Ecologically and/or otherwise sensitive areas: Preferably 5 km; depending on the geo-climatic conditions the requisite distance may be decided appropriately by the agency.
- Coastal areas: Preferably ½ km away from high tide line (HTL).
- Flood plain of the riverine system: Preferably ½ km away from flood plain or modified flood plain affected by dam in the upstream or flood control systems.
- Transport/Communication System: Preferably ½ km. away from highway and railway line.
- Major settlements (3,00,000 population): Distance from major settlements is difficult to maintain because of urban sprawl. At the time of siting of the industry, if the notified limit of any major settlement is found to be within 50 km from the project boundary, the spatial direction of growth of the settlement for at least a decade must be assessed. Subsequently, the industry may be sited at least 25 km from the projected growth boundary of the settlement.
- For all new projects, preferred location may be the sea coast with adequate plan for safeguarding the marine ecology.
- Critically polluted areas are identified by MoEF, from time-to-time. Current list of critically polluted areas is given in **Annexure IV**.

Note:

Ecological and/or otherwise sensitive areas include (i) Religious and Historic Places; (ii) Archaeological Monuments (e.g. identified zone around Taj Mahal); (iii) Scenic Areas; (iv) Hill Resorts; (v) Beach Resorts; (vi) Health Resorts; (vii) Coastal Areas rich in Corals, Mangroves, Breeding Grounds of Specific Species; (viii) Estuaries rich in Mangroves, Breeding grounds of

Operational Aspects of an EIA

applicable baseline parameters (refer Annexure VII) and impact prediction tools (refer Annexure IX) proposed to be applied.

- The information to be provided in pre-feasibility report, guidelines for filling Form 1 and guidelines for developing draft ToR is summarized in subsequent sections.
- Authority consults the EAC to reply to the proponent. The EAC reviews the application form, pre-feasibility report and proposed draft ToR by the proponent and make necessary additions/deletions to make it a comprehensive ToR that suits the statutory requirements for conducting the EIA studies.
- A site (pipeline route) visit by sub-committees of EAC will be planned, only if considered necessary by the EAC with the written approval of the Chairperson. Project proponent will facilitate such site visits of the sub-committees.
- EAC shall provide an opportunity to the project proponent for presentation and discussions on the proposed project and related issues as well as the proposed ToR for EIA studies. If the State Government desires to present their views on any specific project in the scoping stage, it can depute an officer for the same at the scoping stage to EAC, as an invitee but not as a member of EAC. However, non-appearance of the project proponent before EAC at any stage will not be a ground for rejection of the application for the prior environmental clearance.
- If a new or expansion project is proposed in a problem area as identified by the CPCB, then the MoEF may present their views, if any at the stage of scoping, to the EAC.
- The final set of ToR for EIA studies shall be conveyed to the proponent by the EAC within sixty days of the receipt of Form 1 and pre-feasibility report. If the finalised ToR for EIA studies is not conveyed to the proponent within sixty days of the receipt of Form 1, the ToR suggested by the proponent shall be deemed as final and will be approved for EIA studies.
- Final ToR for EIA studies shall be displayed on websites of the MoEF.
- Applications for prior environmental clearance may be rejected by the concerned Authority based on the recommendations by the EAC at this stage itself. In case of such rejection, the decision together with reasons for the same, shall be communicated to the proponent in writing within sixty days of the receipt of the application.
- The final EIA report and other relevant documents submitted by the applicant shall be scrutinized by the MoEF strictly with reference to the approved ToR for EIA studies.

4.2.1 Pre-feasibility report

The pre-feasibility report should include, but not limited to highlight the proposed project information, keeping in view the environmental sensitivities of the selected site, raw material (limestone, brine, coke, ammonia, *etc.*), technology options (LeBlanc process, Solvay process, *etc.*), and its availability. Information required in pre-feasibility report varies from case to case even in the same sector depending upon the local environmental setting within which the plant is located/proposed. However, the information which may be furnished in the pre-feasibility report may include as under:

I. Executive summary

II. Project details: Description of the project including in particular;

4.3.1 EIA team

The success of a multi-functional activity like an EIA primarily depends on constitution of a right team at the right time (preferable at the initial stages of an EIA) in order to assess the significant impacts (direct, indirect as well as cumulative impacts).

The professional Team identified for a specific EIA study should consist of qualified and experienced professionals from various disciplines in order to address the critical aspects identified for the specific project. Based on the nature and the environmental setting, following professionals may be identified for EIA studies:

- Environmental management specialist/regulatory expert
- Occupational safety and health expert
- Air and noise quality expert
- Water quality expert
- Chemical engineer
- Geology/geo-hydrology expert
- Ecologist
- Marine biologist
- Social scientist, *etc*

4.3.2 Baseline quality of the environment

EIA Notification 2006 typically specifies that an EIA Report should contain a description of the existing environment that would be or might be affected directly or indirectly by the proposed project. Environmental Baseline Monitoring (EBM) is a very important stage of EIA. On one hand EBM plays a very vital role in EIA and on the other hand it provides feedback about the actual environmental impacts of a project. EBM, during the operational phase, helps in judging the success of mitigation measures in protecting the environment. Mitigation measures, in turn are used to ensure compliance with environmental standards, and to facilitate the needed project design or operational changes.

The description of the existing environment should include the natural, cultural, socio-economic systems and their interrelationships. The intention is not to describe all baseline conditions, but to focus the collection and description of baseline data on those VECs that are important and are likely to be affected by the proposed industrial activity.

4.3.2.1 Objective of EBM in the EIA context

The term ‘baseline’ refers to conditions existing before development. EBM studies are carried out to:

- identify environmental conditions which might influence project design decisions (*e.g.*, site layout, structural or operational characteristics);
- identify sensitive issues or areas requiring mitigation or compensation;
- provide input data to analytical models used for predicting effects;
- provide baseline data against which the results of future monitoring programs can be compared.

At this stage of EIA process, the EBM is primarily discussed in the context of first purpose wherein feedback from EBM programs may be used to:

- determine available assimilative capacity of different environmental components within the designated impact zone and whether more or less stringent mitigation measures are needed; and
- improve predictive capability of EIAs.

There are many institutional, scientific, quality control, and fiscal issues that must be addressed in implementation of an environmental monitoring program. Careful consideration of these issues in the design and planning stages will help avoid many of the pitfalls associated with environmental monitoring programs. Such major issues are as under:

4.3.2.2 Environmental monitoring network design

Monitoring refers to the collection of data through a series of repetitive measurements of environmental parameters (or, more generally, to a process of systematic observation). Design of environmental quality monitoring programme depends on the monitoring objectives specified for the selected area of interest. Types of monitoring and network design considerations are discussed in **Annexure VI**.

4.3.2.3 Baseline data generation

List of important physical environmental components and indicators of EBM are given in Table 4-3.

Table 4-3: List of Important Physical Environment Components and Indicators of EBM

Environmental Component	Environmental Indicators
Climatic variables	<ul style="list-style-type: none"> ▪ Rainfall patterns – mean, mode, seasonality ▪ Temperature patterns ▪ Extreme events ▪ Climate change projections ▪ Prevailing wind - direction, speed, anomalies ▪ Relative humidity ▪ Stability conditions and mixing height, <i>etc.</i>
Topography	<ul style="list-style-type: none"> ▪ Slope form ▪ Landform and terrain analysis ▪ Specific landform types, <i>etc.</i>
Drainage	<ul style="list-style-type: none"> ▪ Surface hydrology ▪ Natural drainage pattern and network ▪ Rainfall runoff relationships ▪ Hydrogeology ▪ Groundwater characteristics – springs, <i>etc.</i>
Soil	<ul style="list-style-type: none"> ▪ Type and characteristics ▪ Porosity and permeability ▪ Sub-soil permeability ▪ Run-off rate ▪ Infiltration capacity ▪ Effective depth (inches/centimeters) ▪ Inherent fertility ▪ Suitability for method of sewage disposal, <i>etc.</i>
Geology	<ul style="list-style-type: none"> ▪ Underlying rock type, texture



Operational Aspects of EIA

Environmental Component	Environmental Indicators
	<ul style="list-style-type: none"> ▪ Surgical material ▪ Geologic structures (faults, shear zones, <i>etc.</i>) ▪ Geologic resources (minerals, <i>etc.</i>)
Water	<ul style="list-style-type: none"> ▪ Raw water availability ▪ Water quality ▪ Surface water (rivers, lakes, ponds, gullies) – quality, water depths, flooding areas, <i>etc.</i> ▪ Ground water – water table, local aquifer storage capacity, specific yield, specific retention, water level depths and fluctuations, <i>etc.</i> ▪ Coastal ▪ Floodplains ▪ Wastewater discharges ▪ Thermal discharges ▪ Waste discharges, <i>etc.</i>
Air	<ul style="list-style-type: none"> ▪ Ambient ▪ Respirable ▪ Airshed importance ▪ Odour levels, <i>etc.</i>
Noise	<ul style="list-style-type: none"> ▪ Identifying sources of noise ▪ Noise due to traffic/transportation of vehicles ▪ Noise due to heavy equipment operations ▪ Duration and variations in noise over time, <i>etc.</i>
Coastal dynamics and morphology	<ul style="list-style-type: none"> ▪ Wave patterns ▪ Currents ▪ Shoreline morphology – near shore, foreshore ▪ Sediment – characteristics and transport, <i>etc.</i>
Biological	<ul style="list-style-type: none"> ▪ Species composition of flora and fauna ▪ Flora – type, density, exploitation, <i>etc.</i> ▪ Fauna – distribution, abundance, rarity, migratory, species diversity, habitat requirements, habitat resilience, economic significance, commercial value, <i>etc.</i> ▪ Fisheries – migratory species, species with commercial/recreational value, <i>etc.</i>
Landuse	<ul style="list-style-type: none"> ▪ Landuse pattern, <i>etc.</i>

Guidance for assessment of baseline components and attributes describing sampling network, sampling frequency, method of measurement is given in **Annexure VII**.

Infrastructure requirements for EBM

In addition to devising a monitoring network design and monitoring plans/program, it is also necessary to ensure adequate resources in terms of staffing and skills, equipment, training, budget, *etc.*, for its implementation. Besides assigning institutional responsibility, reporting requirements, QA/QC plans and its enforcement capability are essential. A monitoring program that does not have an infrastructural support and QA/QC component will have little chance of success.

standards, objective criteria and similar ‘thresholds’ as eco-sensitivity, cultural /religious values. Often, these are outlined in guidance. A better test proposed by the CEAA (1995) is to determine if ‘residual’ environmental effects are adverse, significant, and likely (given under). But at this stage, the practice of formally evaluating significance of residual impacts, *i.e.*, after predicting the nature and magnitude of impacts based on before-versus-after-project comparisons, and identifying measures to mitigate these effects is not being followed in a systematic way.

i. Step 1: Are the environmental effects adverse?

Criteria for determining if effects are “adverse” include:

- effects on biota health
- effects on rare or endangered species
- reductions in species diversity
- habitat loss
- transformation of natural landscapes
- effects on human health
- effects on current use of lands and resources for traditional purposes by aboriginal persons
- foreclosure of future resource use or production

ii. Step 2: Are the adverse environmental effects significant?

Criteria for determining ‘significance’ are to judge that the impacts:

- are extensive over space or time
- are intensive in concentration or proportion to assimilative capacity
- exceed environmental standards or thresholds
- do not comply with environmental policies, landuse plans, sustainability strategy
- adversely and seriously affect ecologically sensitive areas
- adversely and seriously affect heritage resources, other landuses, community lifestyle and/or indigenous peoples traditions and values

iii. Step 3: Are the significant adverse environmental effects likely?

Criteria for determining ‘likelihood’ include:

- probability of occurrence, and
- scientific uncertainty

4.4 Social Impact Assessment

Social Impact Assessment (SIA) is an instrument used to analyze social issues and solicit stakeholder views for the design of projects. SIA helps in making the project responsive to social development concerns, including options that enhance benefits for poor and vulnerable people while mitigating risk and adverse impacts. It analyzes distributional impacts of intended project benefits on different stakeholder groups, and identifies differences in assets and capabilities to access the project benefits.

The scope and depth of SIA should be determined by the complexity and importance of issues studied, taking into account the skills and resources available. SIA should include studies related to involuntary resettlement, compulsory land acquisition, impact of imported workforces, job losses among local people, damage to sites of cultural, historic





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2023 SCC OnLine NGT 4874

In the National Green Tribunal[†]

(BEFORE B. AMIT STHALEKAR, MEMBER (JUDICIAL) AND DR. ARUN KUMAR VERMA,
 EXPERT MEMBER)

Prafulla Samantray ... Appellant(s);

Versus

Union of India, Ministry of Environment, Forests &
 Climate Change, Through its Secretary, Indira
 Paryavaran Bhawan, Jorbagh Road, Aligunj and Others
 ... Respondent(s).

Appeal No. 02/2021/EZ (I.A. No. 23/2021/EZ)

Decided on September 4, 2023, [Reserved On:— September 21st,
 2023]

Advocates who appeared in this case :

Counsel for Appellant(s):

Mr. Kaustav Dhar, Advocate

Counsel For Respondent(s): Mr. Soumitra Mukherjee, Advocate a/w

Ms. Anamika Pandey, Advocate for R-1,

Mr. Shakti Prasad Panda, AGA for R-2,

Ms. Papiya Banerjee Bihani, Advocate for R-3,

Mr. Swarajit Dey, Advocate a/w Ms. Riddhi Jain, Advocate for R-4,

The Judgment of the Court was delivered by

B. AMIT STHALEKAR, MEMBER (JUDICIAL):— Heard the learned Counsel for the parties and perused the documents on record.

2. The Appellant in the present Appeal is seeking quashing of the Environmental Clearance dated 02.02.2021 granted by the Ministry of Environment, Forests and Climate Change to M/s Neyveli Lignite Corporation India Limited (NLCIL) for its 3×800 MW Thermal Power Plant in the area of Talaibira which is part of the IB Valley in Jharsuguda District of Odisha.

3. The contention of the Appellant is that the Environmental Impact Assessment ('EIA' for short) was made but various factors have not been taken into consideration and the Appellant has highlighted the inadequacies given in the Report of the Sub-Committee constituted by the Expert Appraisal Committee ('EAC' for short) which, according to the Appellant, was not considered by the EAC while granting the Environmental Clearance.

4. The Appellant has further alleged that the Thermal Plant is being set-up in a 'Critically Polluted Area' and impact thereof on ambient air quality, water bodies, land health, etc., have not been well studied in the EIA report.

5. Briefly stated the facts of the present case as mentioned in para 5 of the Memo of Appeal, read as under:—

"A. On 05.09.2017 an Online Application for grant of ToR was submitted by the Project Proponent and the matter was taken up on 25th September 2017 for grant of ToR in the 10th meeting of the Re-Constituted Expert Appraisal Committee (EAC). Considering the environmental sensitivity and location of the project, the committee deferred the project for making a site visit by a Sub-Committee consisting of 4 members which shall visit the project site.

B. On 04th November, 2017 the Sub-Committee visited the site and submitted its Report in the 13th meeting of the Re-constituted Expert Appraisal Committee (EAC) held on 28th November, 2017. The EAC recommended the grant of ToR subject to submission of revised layout along with following additional conditions:—

- (i) All the recommendations made in the site visit of the Sub-Committee shall be followed*
- (ii) The proposed power plant area shall be reduced and the Raw Water Reservoir area be shifted near to the existing water bodies. Re-alignment of proposed power plant is to be done and the revised map is to be submitted.*
- (iii) Ficus species to be raised in and around temples.*

C. Public hearing for the project was conducted on 13.11.2019 at Jharsuguda and on 10.01.2020 at Sambhalpur, Odisha, after which the final EIA Report was submitted in January, 2020.

D. On 10th April, 2020 the 39th meeting of the Re-Constituted Expert Appraisal Committee (EAC) was held for considering the project for grant of Environmental Clearance. as the EIA Report was found lacking in several aspects the Project Proponent was directed to revise the EIA Report according to the observations of the EAC.

E. On 1st May, 2020 ADS was sought and reply was submitted by the Project Proponent on 19th June, 2020.

F. On 19th June, 2020, Revised EIA Report was submitted by the Project Proponent.

G. On 28.07.2020 in the 1st meeting of the Re-Constituted Expert Appraisal Committee (EAC) held for considering the project for grant of Environmental Clearance it was noted by the EAC that several recommendations made by the Sub-Committee had not been addressed and the proposal was deferred for seeking further clarifications.

H. On 9th August, 2020, ADS was sought by EAC and reply was submitted by the Project Proponent on 4th November, 2020.

I. On 17th November, 2020, in the 4th meeting of the Re-Constituted Expert Appraisal Committee (EAC) held for considering the project for grant of Environmental Clearance the project was recommended for grant of Environmental Clearance.

J. On 02nd February, 2021, Environmental Clearance was granted to the Project Proponent for establishing the 3×800 MW NLC Talabira Thermal Power Plant."

6. During the course of the hearing, following issues/points have been raised and argued by the learned Counsel for the Appellant:—

- (I) Lack of Cumulative Impact Assessment;**
- (II) Social Impact Study has not been done;**
- (III) False Air Quality Baseline considered for Air Modeling;**
- (IV) Health Study has not been done; and**
- (V) Public Hearing has not been carried out,**

7. The State Pollution Control, Odisha, Respondent No. 3, has filed affidavit dated 27.08.2021, stating therein that as per the provisions of the EI A Notification, 2006, the role of the State Pollution Control Board is to facilitate the conduct of public hearing and forward the proceedings of the Public Hearing to the concerned regulatory authority for consideration of grant of Environmental Clearance. It is stated that public hearing for Jharsuguda District was held on 13.11.2019 and the proceedings of the public hearing were forwarded to the MoEF&CC, Government of India, vide State Board's letter dated 05.12.2019. Public Hearing for Sambalpur District was held on 10.01.2020 and the proceedings thereof were also forwarded to the MoEF&CC, Government of India, vide State Board's letter dated 01.02.2020.

8. The Respondent No. 2, Additional Secretary, Forest, Environment & Climate Change Department, Government of Odisha, has filed affidavit dated 23.12.2021, stating therein that the Project in question does not come under the purview of the State Government and the State Government has no role to play in the matter.

9. Counter-affidavit dated 13.05.2022 has been filed by the Respondent No. 1, Ministry of Environment, Forests and Climate Change.

10. Counter-affidavit dated 17.05.2022 has been filed by the Respondent No. 4, M/s NLC India Limited.

11. Additional affidavit dated 05.12.2022 has been filed by the Appellant.

12. Final EIA Report, January 2020, has filed by the Appellant.

13. Additional affidavit dated 11.07.2023 has been filed by the Appellant.

14. Affidavit in reply dated 27.07.2023 has been filed by the Respondent No. 4, M/s NLC India Limited.

15. The case of the Respondent No. 4, Project Proponent, is that the Project in question is being implemented to supply power to the States in

India being States of Odisha, Tamil Nadu, Kerala and Pondicherry. It is stated that the Respondent No. 4 has been granted Environmental Clearance on 02.02.2021 for operating 3×800 MW Thermal Power Plant. The Project site is at Kumbhari and Tareikela Villages in District-Jharsuguda and Thelkolo Village in District-Sambalpur, Odisha.

16. In the affidavit of the Project Proponent it is stated that the Central Pollution Control Board has carried out the physical study of the industrial clusters in the country with reference to the Comprehensive Environmental Pollution Index ('CEPI' for short) which includes weightages on the nature of pollutants, ambient pollutant concentrations, receptors (number of people affected) and additional high risk element and on the basis of the study jointly carried out by the Central Pollution Control Board and the State Pollution Control Boards, industrial clusters were notified as 'Polluted Industrial Areas' (PIAs). These PIAs were then ranked as 'Critically Polluted Area' (CPA), 'Severely Polluted Area' (SPA) and 'Other Polluted Area' (OPA), depending upon the CEPI scores of each of these industrial areas. As per the CEPI score:—

(I) 'Critically Polluted Areas' (CPAs) are those areas crossing CEPI score 70;

(II) 'Severely Polluted Areas' (SPAs) were given the index between 60 to 70; and

(III) 'Other Polluted Areas' (OPAs) were given >60. It is stated that as per the study, the Central Pollution Control Board identified 100 polluted industrial clusters which includes:—(i) 38 CPAs, (ii) 31 SPAs, and (iii) 31 OPAs.

17. The case of the Respondent No. 4 is that as per the CEPI index, Jharsuguda is 37.20 and, therefore, the Jharsuguda falls in the 'Other Polluted Areas' (OPAs). It is also stated that since the Sambalpur is not included in list of 100 industrial clusters, therefore, Sambalpur is not a notified 'Polluted Industrial Area' PI A.

18. The contention of the Appellant is that Environment Impact Assessment ('EIA' for short) has failed to address the issues relating to compliance of ToR i.e., Terms of Reference. The specific contention of the learned Counsel for the Appellant is that the recommendations of the Sub-Committee dated 04.11.2017 had not been complied with by the EIA. The recommendations of the Sub-Committee and the contention of the Appellant thereto read as under:—

S. No.	Sub-Committee recommendation	Contentions of the Appellant
1	In the vicinity of the proposed power plant, cluster of power plants, Integrated steel plants, Alumina Plants, Open cast Coal	No data has been used in modeling for air emission from all the point sources.

	<i>Mines etc existing, cumulative pollution level to be assessed by considering all the point sources including the proposed TPS.</i>	
2	<i>Due to construction of boundary wall after leaving 500 m width from the HFL, the villagers shall not have direct access to their agricultural land. Therefore an approach along the boundary wall of power plant should be constructed so that villages can have easy access to their agricultural fields.</i>	<i>No plan has been submitted to show said access road for villagers. Moreover, in the NLC reply dated 4th November it is mentioned that they will acquire additional land for developing green belt between 250 meter line and the river bank to compensate shortage in</i>
3	<i>As per Hon'ble Supreme Court, no construction within 500m width from the HFL shall be proposed. The area requiring for construction of over bridges should be included in the proposed project. and accordingly necessary permission to be taken from the competent authorities.</i>	<i>Issues with regard to maintaining a no construction zone within 500 meter width of river HFL is not complied.</i>
4	<i>The course of Nala exists in the proposed Ash pond areas should not be diverted and necessary protection measures such as proper lining at both banks, etc. to be provided. Ash pond area requires to be realigned so that the village shall remain outside of the boundary of the propose ash pond area and fresh lay out map, in this regard, to be submitted.</i>	<i>i) At few places the distance between proposed ash dyke and river Bedan is less than 500 m. revised area plan superimposed on google earth is still showing habitation on northern and southern part of the proposed ash dyke. Moreover, the edge of ash dyke at few places are less than 500 m which shown in red line Annexure-A8. Moreover, superimposed revised layout plan on Google earth is still showing that about 70% area of the proposed ash pond will get inundated in 50 and 100 years of return flood scenario which is annexed as Annexure -A9.</i>

		<p>ii) <i>The argument submitted by the NLC about 100% fly ash utilization is not sustainable as they have not undertaken any demand supply gap analysis report to claim that 100% of the generated fly ash will be utilized within 100 km of the proposed project site.</i></p> <p>iii) <i>No plan has been submitted for the disposal of fly ash in the mine void of captive Talabira mine.</i></p>
5	<p><i>Green Belt between the village and the proposed ash pond will be developed. Fresh water available in the existing water bodies in the proposed project should be reused for construction work to minimize requirement of fresh water. No ground water shall be drawn for construction work.</i></p>	<p><i>No plan has been submitted in the revised lay out map regarding development of green belt between village and the proposed ash pond.</i></p>
6	<p><i>The course of Nala exists in the proposed ash pond areas should not be diverted any necessary protection measures such as proper lining at both banks, etc. to be provided.</i></p>	<p><i>NIH report identified two options for the nallah, and it did not express a preference for either option. Option one was to leave the nallah undisturbed and to build separate fly ash and bottom ash impoundments to the north and south of the nallah, respective NLC is destroying a functioning nallah in order to gain a relatively tiny amount of additional ash disposal capacity, contrary to the ToR and sub-committee recommendation.</i></p> <p><i>NLC's motive for ignoring the sub-committee and the ToR recommendations is stated in their response above; they</i></p>

		<i>want to maximize ash basin storage capacity at the expense of destroying a functioning</i>
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19. We may, therefore, examine each of the issues raised by the Sub-Committee as well as the contention of the Appellant and also examine the question relating to compliance/non-compliance of the recommendations of the Sub-Committee.

20. Item No. 1 of the Sub-Committee recommendation that '*in the vicinity of the proposed power plant, cluster of power plants, Integrated steel plants, Alumina plants, Open cast Coal Mines etc. existing, cumulative pollution level to be assessed by considering all the point sources including the proposed TPS*', the contention of the Appellant is that no data has been given in the modeling for air emission from all the point sources.

21. We find that the recommendation of the Sub-Committee in Item No. 1 has been specifically dealt with in Chapter 4 of the EIA Report. The cumulative pollution level assessed considering the industries in the vicinity and the results are given in section 4.4 of the EIA Report. The EIA Report has been prepared by the ABC Techno Labs India Private Limited, an ISO certified company, accredited by NABL, NABET and MoEF, and the study period is January-March, 2018. The said Final EIA Report has been filed with the counter-affidavit of the Respondent No. 4 dated 17.05.2022.

22. With regard to the Cumulative Impact Study of Pollution, Section 4.4 of the Final EIA Report deals with "**Air Quality Im pacts**":—

- A. In the Report it is noted that apart from various sources of air emission during construction phase including site clearing, demolition activities, vehicle movement, material storages and handling and operation of construction equipment result in temporary degradation of air quality. However, it is noted that Particulate Matter (PM10 & PM 2.5) rise in ambient air will be coarse and will settle within a short distance close to the construction site. Hence, dust and other emissions are unlikely to spread sufficiently to affect the surrounding villages of the project site.
- B. It is also noted in the Report that emission from various construction machinery fuelled by diesel and from mobile source will be in the form of CO, NOx and SO2. It is also noted that impact on air quality will not be significant as the pollutant emission activities (point and area sources) will be limited within the project boundary and the activities will be short term.
- C. Mitigation Measures have been suggested in Section 4.4.1 of the Report.

23. Section 4.4.2 of the Final EI A Report deals with "**Noise Quality Impacts**":—

- A. The Report notes that the general noise levels during construction phase such as due to working of heavy earth moving equipment and machinery installation may sometimes go upto 90 dB(A) at the work sites in the day time. However, it is noted that noise level will attenuate fast with increase in distance from noise source. Impacts due to noise during construction activities will be minimal since the settlements are of scattered nature.
- B. Mitigation Measures have been suggested in Section 4.4.3 of the Report.

24. Section 4.4.4 of the Final EI A Report deals with "Water Quality Impacts":—

- A. The Report notes that during construction phase of the proposed Project water will be used for construction of civil structures, dust suppression and drinking purpose. The construction water requirement of the Project will be met from Bedhan River through Barge mounted temporary pumping system. It is also noted that the likely impacts on water quality during the construction phase may mainly arise from inappropriate disposal of construction waste and wastewater generated from the construction sites. It is also noted that the domestic water requirement during construction phase will be limited to drinking water and for sanitation and all the domestic wastewater generated from the site will be sent to septic tanks followed by soak pits so that it shall not contaminate the ground water in the nearby areas.
- B. The Report also notes that during the monsoon season there are chances of wash out of mud and debris in the run-offs. This may result in suspended solids and turbidity in run offs water during the monsoon period but this impact shall be lasting only for the duration of the construction period. Efforts be made to reduce the suspended solids content of storm water run-offs by routing the storm water drains through settling tanks/catch pits.
- C. The Report further notes that liquid effluents generated shall be collected and treated/recycled and an independent plant effluent drainage system would be constructed to ensure that plant effluents do not mix with storm water drainage. The Report also notes that it is anticipated that there will be no significant impact on the surface water or ground water hydrology and water use of the area. Rain water harvesting will be carried out.
- D. Mitigation Measures have been suggested in Section 4.4.4.1 of the Report.

25. Section 4.4.5 of the Final EI A Report deals with "Land Use and Land Environment Impacts":—

- A. The Report notes that the proposed Project will be housed at two Villages - Taraikela and Kumbhari. To optimize cutting and filling

quantities, the finished floor level of plant area has been kept at RL (+) 203m. The formation level of western side green belt area is kept at 202.5m and eastern side green belt area at 202.0m.

B. Mitigation Measures have been suggested in Sections 4.4.6 and 4.4.6.1 of the Report.

26. Section 4.4.7 of the Final EI A Report deals with "Solid Waste Generation (Hazardous and Non-Hazardous) and Disposal Impacts:—"

A. The Report notes that during construction phase, solid waste such as - excavated soil, debris, stone, bricks, sand, metal waste, polythene sheets, etc. will be generated which may contaminate soil at plant site temporarily and will be restricted to a small area. The Report also mentions that procedures for maintenance of equipment will ensure that this risk is minimized and clean up response is rapid, if any spill occurs. Hence, waste generated will be disposed of by selling to appropriate vendors as per Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, and amendments thereto.

B. The Report also notes that the Municipal Solid Waste generated by the construction work force will be minimal as most of them will belong to local areas and no construction camps are proposed within the Project site. The waste so generated will be collected, segregated and will be sent to the solid waste disposal site/land-fill allocated by the local administrative authorities.

C. Mitigation Measures have been suggested in Section 4.4.8 of the Report.

27. Section 4.4.9 of the Final EI A Report deals with "Socio-Economic Environment Impacts":—

The Report notes that construction will involve generation of a lot of employment, both direct and indirect, which will affect the economy of the study area.

28. Section 4.4.10 of the Final EIA Report deals with "Hydrology and Drainage":—

The Report notes that natural drainage system will be preserved and not altered due to the proposed Project. Storm water will be collected through storm water drains and will be stored in water bodies, planned to be distributed equally in the plant premises so that maximum rainwater will be recharged back to aquifer. The Project development will not alter any water body or pond, therefore, no impact is anticipated on the hydrology of the study area.

29. Section 4.4.11 of the Final EIA Report deals with "Terrestrial Ecology Impacts":—

A. The Report notes that the activities of proposed Project will be confined to the Project site within the boundary of existing plant premises. The site is grassland with no tree cover and does not come under any

forestry and agricultural activities. There are few shrubs along with seasonal grasses which plant species are more vigorously disturbed in the buffer zone and, therefore, the present activities will not cause any significant loss of any important flora.

B. Mitigation Measures have been suggested in Section 4.4.12 of the Report.

30. Section 4.5 of the Final EIA Report deals with "Potential Impacts during Operation Phase":—

The Report notes that the potential impacts during the operation phase have been identified within the project site as well as the study area of 10 km radial around the proposed project such as:—

- *Air Environment*
- *Water Environment*
- *Land Environment*
- *Noise Environment*
- *Socio-economic Environment*

31. Section 4.5.1 of the Final EI A Report deals with "Air Environment Impacts":—

A. The Report mentions that the pre-project (baseline) ambient air quality status in the study area during winter season of 2018 indicates that all the criteria pollutants are well within the prescribed NAAQS for industrial, residential, rural and other areas. The sources of emission during operation phase have been identified as from:—

- *TP Plant Stacks*
- *Emergency Power Supply System-DG sets*
- *Coal Handling and Stockpiles.*

B. The Report further mentions that fugitive dust will be generated from handling and feeding of raw materials which is sought to be controlled by water sprinkling as well as use of bag filter. It is also mentioned that adequate stack height will be provided for better dispersion of flue gas as per the guidelines of the CPCB/CECB and in addition, adequate green belt will be developed by the Project Proponent for further control of air pollution due to fugitive emissions at the site.

32. Section 4.5.3 of the Final EI A Report deals with "Meteorological Data":—

A. The Report notes that the Meteorological data collected from 1st January to 31st March 2018 has been given in Chapter-3 which indicates that the predominant wind direction is blowing from North-East to South-West. Wind speed, wind direction and temperature have been processed to extract the 8-hourly mean meteorological data for application in AERMOD.

B. Summary of Predicted Ground Level Concentrations has been dealt

with through tables showing 24-hours-PM (Scenario-1), 24-hours-SO₂ (Scenario-1), 24-hours-NO₂ (Scenario-1), 24-hours-PM (Scenario-2), 24-hours-SO₂ (Scenario-2) and 24-hours-NO₂ (Scenario-2) in Section 4.5.6 of the Report.

C. Table No. 4 to 10 shows resultant concentrations after implementation of proposed project along with the existing industries in the vicinity (cumulative impact) which read as under:—

Sl. No.	Pollutant	Maximum Baseline Concentration, $\mu\text{g}/\text{m}^3$	Predicted Incremental Increase GLC $\mu\text{g}/\text{m}^3$	Resultant Maximum Concentration $\mu\text{g}/\text{m}^3$	NAAQs Limits $\mu\text{g}/\text{m}^3$
1.	Particulate Matter	79.60	1.8613	81.4613	100
2.	Sulphur Dioxide	11.70	8.4058	20.1058	80
3.	Nitrogen Dioxide	24.90	8.1125	33.0125	80

33. Section 4.6 of the Final EI A Report deals with "**Discussion**":—

- A. The Report notes that the ambient air quality values were reported to be 11.70, 24.90 and 79.60 $\mu\text{g}/\text{m}^3$ for SO₂, NO_x and PM respectively. The cumulative maximum worst case incremental GLCs of the study area were recorded to be 8.40 $\mu\text{g}/\text{m}^3$ for SO₂, 8.11 $\mu\text{g}/\text{m}^3$ for NO_x and 1.86 $\mu\text{g}/\text{m}^3$ for PM. The predicted maximum worst case background concentrations are expected to be 20.10 $\mu\text{g}/\text{m}^3$ for SO₂, 33.1 $\mu\text{g}/\text{m}^3$ for NO_x and 81.46 $\mu\text{g}/\text{m}^3$ for PM within 10 km radius of the study area.
- B. Mitigation Measures have been suggested in Section 4.6.1 of the Report.

34. Section 4.7 of the Final EIA Report deals with "**Water Environment Impacts**":—

- A. The Report notes that the consumptive water requirement for 2400 MW capacity project is estimated as 72 cusecs. The water is proposed to be drawn from Hirakund reservoir at a point near the intake location of M/s Bhushan Steel and Power Ltd., at a distance of about 20 km.
- B. Mitigation Measures have been suggested in Section 4.7.1 of the Report.

35. Section 4.8 of the Final EIA Report deals with "**Noise Environment**":—

The Report mentions that stationary sources due to operation of heavy duty machinery at the project site like Compressors, Pumps, Turbines, Boilers etc. Mobile sources corresponding to mainly vehicular traffic for staff mobilization, material transport and fuel transport to project site etc.

materials loading and unloading at conveyors will also generate some noise.

36. Section 4.10 of the Final EIA Report deals with "Ecology":—

Under the heads 'Loss of Species', 'Gaseous Pollution', 'Dust Generation', 'Noise Pollution', 'Congregation of Labour', 'Effluent Discharge', mitigation measures have been given in the Report.

37. Section 4.14 of the Final EIA Report deals with "Greenbelt Development Programme":—

The Report notes that the plant area is 602 acres and Reservoir Area is 88 acres. As per CEA norms, one third of plant area needs to be earmarked for green belt which works out to 230 acres of NTTTP, whereas 252 acres of green belt is envisaged. The Report further mentions that the ideal size of green belt shall be between 10 and 50 meter wide and run the length of roads, major structures and open spaces. Species of plants to be planted have been given in Table 4-11 of the Report.

38. Section 4.18 of the Final EIA Report deals with "Waste Generation":—

The Report mentions that the waste generated at the project site falls in categories of hazardous and non-hazardous wastes which are to be managed as per the prevailing regulatory norms.

39. Section 4.19 of the Final EI A Report deals with "Non-Hazardous Waste":—

A. The Report notes that the solid/semi solid waste envisaged from the proposed Project are spent oils, lubricants and chemicals etc. from the process units and clarifier sludge from raw water treatment plant, oily sludge from wastewater treatment plant as well as biological sludge from sewage treatment plant; coal dust will be generated generally at the conveyor transfer points, coal unloading area and coal stockpile area.

B. The Report further notes that dust suppression/dust extraction facilities will be provided including enclosed galleries.

40. Section 4.20 of the Final EI A Report deals with "Hazardous Waste":—

The Report notes that the hazardous waste generated from the Proposed Project will be waste oil and grease drained out of gear boxes and other equipment and the same will be disposed of as per the Hazardous Waste Management Rules to the licensed vendors.

41. Section 4.21 of the Final EI A Report deals with "Socio-Economic Impacts":—

A. The Report mentions that the proposed Project will support strategic needs of the communities and villages in the area. The economic point of view is that the Project will generate employment and help people to earn money as well as ability to pay for consumption; the proposed Project will lead to infrastructure development in the area such as -

road, schools, health facilities, drinking water facilities, market facilities, processing facilities etc.

- B. The Report further mentions that in-migration will boost demand for several goods, services, communities and it will create a pressure to improve productivity of natural and human resources in the area.

This also address the Issue Nos. I & II raised by the learned Counsel for the Appellant.

42. Learned Counsel for the Appellant submitted that the AAQ7 Monitoring Station, Jharsuguda, is situated only 1.3 kilometers from the Cox Colony. _

43. The learned Counsel further referred to Annexure-14 (page 177) to the Memo of Appeal and submitted that the National Air Monitoring Programme of 2018 for Jharsuguda shows average concentration of PM10 as being higher than the national standard. Learned Counsel specifically submitted that for Cox Colony PM10 level shows 106 which is higher than the prescribed standard of 100 and submitted that Cox Colony is located only 1.3 kilometers north of the AAQ7 Monitoring Station.

44. The allegation of the Appellant has been refuted by Mr. Swarajit Dey, learned Counsel for the Respondent No. 4, who has referred to Table No. 3-10 (page no. 621 of the paper book) of the EIA Report for Ambient Air Quality Monitoring Locations and submitted that the distance of Cox colony is 1.3 kilometers further to the North of the Monitoring Station AAQ7, which itself is 9.90 kilometers from AAQ1, Project Site, thus, the total distance of Cox Colony from the Project site AAQ1 is 1.3 + 9.90 i.e., 11.2 kilometers which is outside the study area of 10 kilometers. Learned Counsel further referred to the CEPI scores for industrial areas/cluster monitored during 2018 wherein Jharsuguda (Orissa) is shown at Sl. No. 98 and the CEPI score is shown as 37.20. The scores have already been referred to hereinabove and the score of 37.20, therefore, falls under the heading 'Other Polluted Area' and, therefore, we are of the view that in any case the Project Site does not fall within the 'Critically Polluted Area' or 'Severely Polluted Area'.

This also deals with Issue No. III raised by the Appellant during arguments.

45. As regards the Item No. 2 of the Sub-Committee recommendation, namely, that the Project Proponent should construct a boundary of minimum width of 20 meters having alleviation of at least 202 meters Above Mean Sea Level, the same has been dealt with under the heading '6 Conclusions' (page no. 908 of the paper book) in para 9 that construction of embankments on both left and right bank is also analysed for various return period floods. It is suggested that embankment is to be constructed on both banks as construction of embankments only in right bank (main plant area) will not be able to protect the ash pond area. However, instead of creating embankment along the left bank of river, selective protection to only ash dyke can be made.

46. We find that in Condition No. (viii) of the Environmental Clearance dated 02.02.2021 it is provided that embankment Bund on the banks of the Bhedan river is to be strengthened which is + 1m above the High Flood Level (HFL) limits, so as to prevent flooding. The bund formation shall be developed with a base width of 20 m. In addition, the bund shall also be provided on the other bank of the river to safeguard the ash disposal area. The height of the river bund shall be minimum RL 202 meters. The Project is still at a nascent stage of construction and, therefore, it is premature at this stage to assume that there is violation of Environmental Clearance conditions.

47. Learned Counsel for the Appellant has drawn the attention of the Court to Annexure-A17 (page 216 of the paper book), which is a letter of the Ministry of Environment, Forests and Climate Change dated 19.11.2018 and submitted that directions were given by the MoEF&CC that the Expert Appraisal Committee shall deal with the standard conditions at the time of appraisal of proposal for grant of Environmental Clearance and also with regard to Human Health Environment four directions were given which reads as under:—

1. *Bi-annual Health check-up of all the workers is to be conducted. The study shall take into account of chronic exposure to noise which may lead to adverse effects like-increase in heart rate and blood pressure, hypertension and peripheral vasoconstriction and thus increased peripheral vascular resistance. Similarly, the study shall also assess the health impacts due to air pollution agents.*
2. *Baseline health status within study area shall be assessed and report be prepared. Mitigation measures should be taken to address the endemic diseases.*
3. *Impact of operation of power plant on agricultural crops, large water bodies (as applicable) once in two years by engaging an institute of repute. The study shall also include impact due to heavy metals associated with emission from power plant.*
4. *Sewage Treatment plant shall be provided for domestic wastewater.*

48. We find that these issues have been dealt with in Section 7.9 under the heading "Occupational Safety Management and Surveillance Program" of the Final EI A Report and referring to the provisions of the Factories Act, 1948, the Report notes that the State Government is vested with powers to appoint a competent person to conduct inquiry into the causes of any accident or notifiable diseases. The following measures need to be implemented in the work places to enhance occupational health:—

- *Identify and involve workers in assessing workplace risks,*
- *Assess and consider employees' needs when planning and organizing work,*
- *Provide vehicle, information and training to employees, as well as*

mechanisms for employee feedback such as a suggestion scheme, Occupational health surveillance and Occupational health audit, to develop a system of

- *creating up to date data base on mortality, and morbidity due to Occupational diseases and use it for performance monitoring of the same and*
- *extending support to the state government for effective enforcement of the health provisions stipulated under section 41F of the Factory Act be equipping them with work environment monitoring technologies.*

49. The Report also mentions that a dedicated occupational health center shall be developed consisting of the following facilities:—

- a) *A full time doctor may be appointed to monitor the day-to-day occupational health aspects and also to provide medical advice to the workers, employees and residents and residents of the colony,*
- b) *Minimum facilities such as oxygen cylinder for emergency medical use, two bed clean room for first aid applications, first aid kits as per the Factories act,*
- c) *ECG and X-ray facilities, Peak Expiratory flow Meter to check the lung function,*
- d) *As part of the surveillance program, the following minimum medical expansion may be undertaken during the pre-employment phase:—*
 1. *General physical examination and blood pressure,*
 2. *X-Ray of chest & ECG,*
 3. *Sputum examination,*
 4. *Detailed routine blood and urine examination,*
 5. *Audiometry, and*
 6. *Spirometry*
- e) *As part of the routine and annual medical examinations on the persons working in the high noise generating areas, stress areas and dust exposure areas, a comprehensive surveillance program may be adopted.*
- f) *Medical records-A record-keeping system for holding results of medical examinations and reports of systems will be needed as part of the health surveillance scheme. These are confidential records relating to individuals.*
- g) *As part of the health surveillance programme, workers should be informed of the confidential results of such assessment and if any implications of the findings, such as the likely effects of their continuing to work with vibration.*

Thus, Issue No. IV raised by the learned Counsel for the Appellant has been adequately dealt with in the EIA Report.

50. With regard to Issue No. V raised by the Learned Counsel for the

Appellant that Public Hearing has not been carried out, we may note that Public Hearing was held on 13.11.2019 at 10:00 AM in Village-Tareikela, in front of Gariadihi up school near Hirma Village of Jharsuguda District, Odisha, and on 10.01.2020 at Khumbhari and Tareikela in the District of Jharsuguda and Thelkoli Village in the District of Sambalpur (for Sambalpur District).

51. A perusal of the minutes of the 1st meeting of the Re-Constituted Expert Appraisal Committee (EAC) on Environmental Impact Assessment (EIA) of Thermal Power Projects held on 28.07.2020 (Annexure-R2, page 334 of the paper book), filed along with the counter-affidavit of the Ministry of Environment, Forests and Climate Change dated 13.05.2022, issue relating to Public Hearing has been dealt with in Section 1.3.3 sub-para (iv) and it is mentioned that the SIA study enumerated a total 512 families from the list given for survey, of which 291 will be displaced as their residential area is going to be acquired, and 221 families will be affected as their land is going to be acquired for setting-up of the proposed industry in five villages. The expected displaced people were residing in Villages - Tareikela, Kumbhari and Gariadihi Kisan Pada (a hamlet of Hirma Village) and the expected affected people were from Village-Tumbekela, Tareikela, Kumbhari and Hirma.

Name of Village	No. of families	No. of displaced families	Percentage	No. of affected families	Percentage
Hirma	124	39	31.5%	85	68.5%
Kumbhari	163	123	75.5%	40	24.5%
Tareikela	136	129	94.9%	7	5.1%
Tumbekela	89	0	0%	89	100%
Total	512	291	62%	221	38%

52. In Section 1.3.3 sub-para (v) it is also mentioned that most of the people in the Project area wanted to vacate their homes provided they would get suitable monetary compensation for their land, houses and immovable assets. According to them, the cost of land is highest in the area so they should be compensated accordingly.

53. In the sub-para (v) it is further mentioned that owners of land near the Bheden river in Kumbhari and Tareikela Villages wanted to part with their land as they will face problem in cultivation. The proposed Project maps show exclusion of those patches of land and they requested that the company should acquire that patch of land for tree plantation or any other purpose.

54. In this view of the matter, we are of the view that since most the residents of the villages who were to be affected by the proposed Project coming-up were willing to give-up their lands provided they would be adequately compensated for the same, in our opinion, not holding a fresh

Public Hearing after submission of the revised EIA Report would not be fatal to the grant of the Environmental Clearance to the Project.

55. Next referring to Item No. 3 of the Sub-Committee recommendation, namely, that due to construction of boundary wall after leaving 500 meter width from High Flood Line, the villagers shall not have direct access from their agricultural land and, therefore, approach road should be constructed, Mr. Swarajit Dey, learned Counsel for the Project Proponent, has drawn our attention to the Main Plant Area Map filed at page no. 1334 of the paper book, and from the map he has shown that the purple line immediately after the green belt is the road which has been provided for the villagers and in addition, bridges have been constructed over River Bhedan to provide access to the villagers to their agricultural fields. The purple line in the map is marked as 'Peripheral Road' for villages and, therefore, we have no reason to doubt that access road would not be provided for the villagers.

56. Learned Counsel for the Appellant next submitted that no construction within 500 meter width from the High Flood Line shall be proposed as per the directions of the Hon'ble Supreme Court. A perusal of the Map (at page no. 1334 of the paper book), shows that there are no constructions between the area marked in 'white' following the Bhedan river and the road marked in 'purple'. Even otherwise, the township or the Plant itself has not yet been constructed and, therefore, the directions of the Sub-Committee and implementation thereof are all in the future and it would be highly and unfairly presumptive at this stage to believe that the same will not be followed by the Project Proponent.

57. Learned Counsel for the Appellant next submitted Item No. 5 of the Sub-Committee recommendation that construction of Raw Water Reservoir may be shifted towards the existing water pond and space provided for construction of 4th unit of 800 MW may not be kept at the existing proposal as lot of agricultural land is getting affected.

58. Mr. Swarajit Day, learned Counsel for the Project Proponent, in response submitted that the Raw Water Reservoir has been shifted towards the north and the area has been reduced from 126 acres to 88 acres. The Map (at page no. 1334 of the paper book), clearly shows the Raw Water Reservoir area is at a considerable distance from Bhedan river and this area has now been reduced to 88 acres and the area is to the north of the river Bhedan.

59. The next submission of the learned Counsel for the Appellant is with regard to the Item No. 6 of the Sub-Committee recommendation that before any construction is taken up in either of these areas, the transmission lines be shifted.

60. Mr. Swarajit Dey, learned Counsel for the Project Proponent, submitted in this regard that Odisha Power Transmission Corporation Limited (OPTCL) has already been approached to carry out the diversion of

transmission lines and survey for the same by the OPTCL is under progress and the money for the same has already been deposited with the OPTCL.

61. Learned Counsel for the Appellant has next referred to Item No. 7 of the Sub-Committee recommendation and submitted that the Committee has recommended that Ash Pond Area be re-aligned so that the village shall remain outside the boundary of the proposed ash pond.

62. Mr. Swarajit Dey, Counsel for the Project Proponent has referred to the Map (at page no. 1334 of the paper book) and submitted that the Ash Pond Area has been re-aligned in such a manner that the village remains outside the boundary. This is evident from the Map itself. He further submitted that the nalla requires diversion if original alignment is to be maintained, the dyke has to divide and the ash disposal area gets reduced and as per the drainage study this routing is not recommended. Learned Counsel informs that the second alternative for re-routing along the boundary southwards has been suggested by the NIH, Roorkee, and in any case the ash dyke is not crossing the nalla. The nalla has been shown in the Map in two blue lines just above the 'Emergency Ash Dyke (175 acres)' and the area to the north of the nalla has been crossed out with slanting lines which area is shown to have been omitted and, therefore, it is evident from the Map that the Ash Dyke is not dividing the nalla.

63. Learned Counsel for the Appellant next submitted with regard to the recommendation 8 of the Sub-Committee that green belt be developed between village and proposed ash pond.

64. We find from the Map at page no. 1334 of the paper book that green belt area has been demarcated in green and marked as 'Green Belt' and no ground water has been envisaged. For construction purposes, it is mentioned that fresh water available in the existing water bodies in the proposed Project will be re-used for construction work to the extent possible to avoid or minimize requirement of fresh water.

65. Condition (xii) of the Environmental Condition provides that in terms of MoEF&CC Office Memorandum dated 31.10.2019, Green Belt shall be developed in an area of 40% of the total Project Area instead of 33% as the Project is located near IB Valley Critically Polluted Area and that the additional area is to be acquired for meeting the target of 40% Green Belt of the total Project Area.

66. As we have already noted hereinabove the Project is still at a nascent stage and, therefore, assumption of violation of Environmental Clearance conditions at this stage is wholly premature.

67. Appellant has mentioned that issue of carrying capacity was raised during the public hearing of District Jharsuguda, because 802 emitting major industries were quoted to be located in the area according to Greenpeace and Wetland International South Asia Report. It is alleged that Project Proponent did not respond to the query as to any survey to assess the carrying capacity of the area was undertaken before making proposal for

establishment of such large industry. Appellant emphasised that matter is of extreme concern since a number of highly polluting and emission related industries, thermal power plants and coal mines are existing within 10 km zone of Talabira-1-TPP. It was further quoted that in Original Application No. 1038/2018, this Hon'ble Tribunal in its order of 10.07.2019 has observed that:—

"28..... no industrial activities or expansion be allowed with regards to read and orange category units till the said areas are brought within the prescribed parameters or till carrying capacity of area is assessed and new units or expansion is found viable having regards to the carrying capacity of the and environmental norms....."

68. The learned counsel for the Project Proponent argued during hearing that all the studies have been conducted in the EIA according to the ToR given by the MOEF & CC. The observation of the Hon'ble Tribunal was with respect to CPA and SPA, whereas the proposed Plant falls within the OPA. Environmental carrying capacity with respect to industries includes multiple factors such as atmospheric environment, land environment, social economy and water environment, and reflects the threshold of supporting capacity for the industries in a region with specific natural resources and ecological environment. Studies with respect to air, water, land, flora, fauna etc. have been made in the EIA which *inter alia* with other results conveys the carrying capacity too. The Project Proponent in his affidavit has annexed the order of the Tribunal dated 10.07.19 in OA 1038/2018 which contains the CEPI Scores for Industrial Areas/Clusters monitored during 2018 and it gives CEPI score of 37.2 for Jharsuguda at serial number 98. The Tribunal has already decided OA 1038 of 2018 by its order dated 22.08.23 and it has been observed that:—

"144. Central Statutory Regulators i.e., CPCB in the process of its discharge of statutory obligation of taking steps for identification of the most polluted areas so that immediate steps be taken for remediation thereat. It appears to have realised that human activities, that are part of the evolution of urbanization and industrial development, have led to major pollution related issues. These include categorical impact of residential, industrial and other developmental projects such as power plants, mining etc., that affect the environment and human living conditions. Lack of planning and a basic understanding of the ecology affects its balance leading to pollution of water, air, soil and other natural resources.

145. To address the above, CPCB came forward with a lucid cum quantifiable method called CEPI score. The exercise of determination of CEPI score was undertaken and CEPI method was formulated in order to measure, understand and take action on polluters. CEPI bridges perceptive gap between experts, public and Government departments by simplifying complexity of environmental issues. It aims at categorising



critically polluted industrial areas based on scientific criteria so as to ascertain various dimensions of pollution. This is a combined framework used to evaluate the impact caused by industrial clusters on the nearby environment as a numerical value. This was made applicable firstly in respect to areas where there is industrial cluster i.e., the area identified for development of industries by providing requisite infrastructure which are called sometimes Economic Zone, Industrial Estate etc.

146. CEPI score, therefore, is nothing but a methodology of quantifying and numerically marking the environmental status of a particular area. In this case, the areas were industrial clusters in the country."

It clearly means that assessment of CEPI score is to know the environmental status of the concerned regions for establishment/operation of industries as well as remedial action plan that can be made if required. Hon'ble Tribunal has also clarified that there was no blanket ban on the establishment of new industries or expansion if it complies environmental norms and additional environmental stress is properly mitigated.

"221..... With regard to confusion created in respect of Red and Orange category, Tribunal clarified in para 10 that if any Red and Orange category unit are viable by not causing pollution, there is no absolute bar in permitting setting of such industries. MoEF&CC can devise an appropriate mechanism to ensure that new legitimate activity or expansion can take place after due precautions are taken in the areas in question by red and orange category units."

Thus, we do not find any strength in this argument that carrying capacity of the area has not been assessed.

69. No further points were argued by the learned Counsel for the Appellant.

70. For reasons aforesaid, we do not find any merit in the present Appeal and the same is accordingly dismissed.

71. I.As. if any, stand disposed of accordingly.

72. There shall be no order as to costs.

† Kolkata Bench

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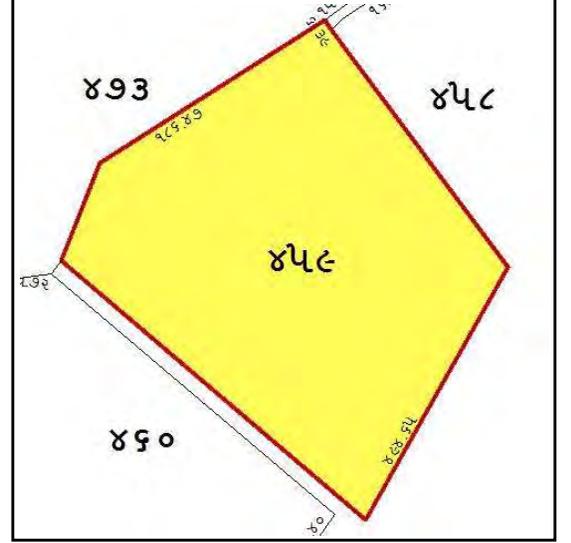
ANNEXURE R/12

[Colly]

ગામ નમૂનો નંબર ૭

(પ્રમોલગેશન નોંધ નં.૩૧૫૫ તા.૨૭/૦૫/૨૦૧૭)

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 ગામ/ મોજે: બાડા
 બ્લોક/ સરવે નંબર: ૪૫૯
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 ખેતરનું નામ: તલાવડી
 અન્ય વિગતો:
 જુનો બ્લોક/ સરવે નંબર: ૩૮૧
 જુના સરવે નંબર ને લગત નોંધ નંબરો: ૨૩૭,૨૧૨૬ |***



લાયક જમીન	ક્ષેત્રફળ હે. આરે. ચો.મી.	ખાતા નંબર/ ક્ષેત્રફળ/ આકાર હે. આરે. ચો.મી.	નોંધ નંબરો અને કબજેદારો ના નામ
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Page 1 of 1

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અન્ય વિગતો:
જુનો બ્લોક/ સરવે નંબર:

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લાયક જમીન	ક્ષેત્રફળ હે. આરે. ચો.મી.	ખાતા નંબર/ ક્ષેત્રફળ/ આકાર હે. આરે. ચો.મી.	નોંધ નંબરો અને કબજેદારો ના નામ
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સેટલમેન્ટ કમિશનર અને જમીન રેકર્ડ નિયામક

ગુજરાત રાજ્ય, ગાંધીનગર

ખ-૫, રેલ્વે ફાટક પાસે, સેક્ટર-૧૪, ગાંધીનગર

ક્રમાંક: એલઆર ૧૩૬૨/રી-સરવે/પોખ/૨૦૧૪-૧૫

તારીખ ૧૩-૦૩-૨૦૧૫

વિષય: સરવે નંબર પૈકીના ખેડવા લાયક પોત ખરાબાની જમીનો લાયક
જમીનમાં લઈ જવા બાબત

સંદર્ભ: ગુજરાત જમીન મહેસુલ નિયમો-૧૯૭૨ના પ્રકરણ -૧૩નો નિયમ - ૭૫

પરિપત્ર

નેશનલ લેન્ડ રેકર્ડ મોડર્નાઇઝેશન (NLRMP) પ્રોગ્રામ હેઠળ રાજ્યના તમામ જિલ્લામાં રી-સરવે કામગીરી પ્રગતિમાં છે. રી સરવે કામગીરી દરમિયાન ખેડવા લાયક હોય તેવા ઘણા પોત ખરાબા ખેડાણ કરેલા માલુમ પડેલ છે. જે અત્રે ધ્યાન પર આવેલ છે. જે બાબતે જરૂરી સુચનાઓ આપવામાં આવે છે.

પોત ખરાબા એટલે સ્થાનિકે વિવિધ બોલીઓ પ્રમાણે જુના રેકર્ડ નોંધાયેલા હોય તેવા ફક્ત ખેતીના જ હેતુઓ સારૂ આકારેલા કોઈ સરવે નંબર પૈકીનો અમુક ભાગ કે વિસ્તાર જે ખેતીના કામ માટે બનાવેલ ઓરડી, મકાન કે ખળા, પથરાળ, ધાર, ખડક, ખાણનોખાડો, ખાર, ટેકરી જેવા ખરાબા કે જેનો "અ" વર્ગના ખરાબા તરીકે સમાવેશ થયેલ છે તથા નાળુ, રસ્તો, હટેમારગ, વહેળો, પાણીના ધોરીયા, તળાવ, કબ્રસ્તાન, દેરી તથા તળાવ જેવા ખરાબા કે જેનો "બ" વર્ગના ખરાબા તરીકે સમાવેશ થયેલ છે.

"બ" વર્ગના ખરાબા એટલે એવી જમીન ખેડવા લાયક હોવા છતાં સાર્વજનિક હેતુ માટે વપરાતા હોવાથી ખેડવા સામે પ્રતિબંધ હોય, જેમ કે રસ્તો, હટેમારગ, વહેળો, પાણીના ધોરીયા, તળાવ, કબ્રસ્તાન, દેરી વગેરે.

"અ" વર્ગના ખરાબા કે જેનો કબજો ભોગવટો કબજેદાર એકલાનો હોય, તેને કબજેદાર પોતાના ખર્ચે ખેડવા લાયક કરે તો તેને કાયમ કરવા પાત્ર છે.

આમ, પોત ખરાબાના ક્ષેત્રફળ બાબતે નીચે મુજબની સુચનાઓનો અમલ કરવા આથી જણાવવામાં આવે છે.

૧, " અ " વર્ગના ખરાબા સ્થળે હયાત હોય, તો ખરાબા તરીકે ચાલુ રાખવા. અને જે પૈકી ભાગ/હિસ્સામાં જેટલું જણાઇ આવે તેટલું ક્ષેત્રફળ ખરાબા તરીકે લેવા.

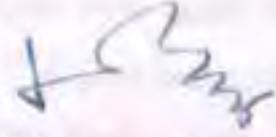
૨, " અ " વર્ગના ખરાબા અગર જો સ્થળે હયાત ન હોય અથવા ખેડાણ થઇ ગયું હોય, તો તે ખરાબા તરીકે ન લેતા તેને લાયક તરીકે ગણવું. આ જમીન તે ધારણ કરનાર કોઇ સમયે ખેતીના કામ માટે વાપરી શકશે તે માટે વધારાની આકારણી આકારવાની થશે નહીં.

૩, " બ " વર્ગના ખરાબા અવશ્ય ચાલુ રાખવા.

નોંધ: ૧. કાયમ કરેલ ખરાબાનો ક્ષેત્રફળ ગા.ન.નં.૭ માં દર્શાવેલ હોય, તેનાથી વધવું જોઇએ નહીં.

૨. ગા.ન.નં.૭ માં દર્શાવેલ ન હોય, અને સ્થળે ખરાબા જણાઇ આવે તેવા ખરાબા તરીકે ગણવા નહીં

ઉપરોક્ત સુચનાઓનો તાકીદે અમલ કરવાનો રહેશે.



(મનોજ અગ્રવાલ) આઇએએસ
સેટલમેન્ટ કમિશનર અને જમીન રેકર્ડ નિયામક
ગુજરાત રાજ્ય, ગાંધીનગર

નકલ સાદર રવાના: અધિક મુખ્ય સચિવશ્રી, મહેસુલ વિભાગ, સચિવાલય તરફ જાણ સારું.

નકલ સવિનય રવાના :

૧. નિયામકશ્રી, દીનદયાળ મોજણી અને મહેસુલી વહીવટ સંસ્થા, ગાંધીનગર તરફ

૨. જિલ્લા કલેક્ટરશ્રી તમામ તરફ જાણ સારું

૩. સુપરિન્ટેન્ડેન્ટ જમીન રેકર્ડ કમ એક્ટ્રિ. અધિકારીશ્રી, તમામ તરફ જાણ તથા અમલ સારું.

૪. ડી.ઇ.લે.રે.શ્રી તમામ તરફ જાણ અને અમલ સારું.

૫. પી. એ. ટુ સેટલમેન્ટ કમિશનર અને જમીન રેકર્ડ નિયામકશ્રી, ગુ. રા. ગાંધીનગર

૬. સિલેક્ટ ફાઇલે

Original in Gujarati – Translated into English

Settlement Commissioner and Director of Land Records

Gujarat State, Gandhinagar

Kh-5, Near Railway Gate, Sector-14, Gandhinagar

No.LR1362/Re-Survey/Pokh/2014-15

Date: 13/03/2015

Sub: Reg. converting Kharaba (Waste) lands from the survey number paiki into suitable land.

Ref: Rule - 75 of Chapter -13 of Gujarat Land Revenue Rules -1972

CIRCULAR

Re-survey work is in progress in all the districts of the state under the National Land Record Modernization Program (NLRMP). During the re-survey work, it is found that many areas that were suitable for cultivation had been ploughed. This has been taken into consideration here. The necessary instructions are given in this regard.

A plot of land means a part or area of a survey number, which is exclusively for agricultural purposes only, as recorded in old records according to various local dialects, which is a plot of land made for agricultural purposes, such as a room, building or quarry, rocky area, edge, road, quarry pit, mine shafts, hill, which is included as "A" category plot of land and a plot of land like a drain, road, boundary road, stream, watercourse, pond, cemetery, temple and pond which is included as "B" category plot of land.

"B" class waste means land that is suitable for cultivation but is prohibited from cultivation due to its use for public purposes, such as roads, boundaries, streams, watercourses, lakes, cemeteries, monasteries, etc.

"A" class land, the possession and enjoyment of which is the sole property of the occupier, is eligible for permanent lease if the occupier makes it suitable for cultivation at his own expense.

Thus, it is hereby advised to implement the following instructions regarding the area of the wasteland.

1. If there is a "A" class bad place, it should be continued as bad, and as much area as is found in the part/part thereof should be taken as bad.
2. "A" class waste, if it is not existing in the place or has been ploughed, then it should not be considered as waste and should be considered as

eligible. This land can be used by the holder for agricultural work at any time and no additional assessment will be made.

3. The “B” class waste must kept continue.

Note: Permanent made Kharaba (Waste) area should not exceed that shown in village sample no 7.

Not shown in village sample no 7 and found to be Kharaba (Waste) at the site should not be considered as Kharaba (Waste)

The above instructions must be implemented immediately.

Sd/
(Manoj Agarwal) IAS
Settlement Commissioner and Director of Land Records
Gujarat State, Gandhinagar

Copy to : Chief Secretary, Revenue Department, Sachivalaya – for inf.

1. Director, Survey and Revenue Administration Dept.,
2. District Collectors All – for inf.
3. Superintendent Land Record cum Consolidation Officer All - for information & implementation please.
4. DELR All – for information & implementation pl.
5. PA to Settlement Commissioner & Land Record Director, Gujarat State, Gandhinagar.
6. Select File.

Village Sample No. 7

District : Kutch
27/06/2017)

(Promulgation Note No. 3155 Date

Taluk : Mandvi

Village/Moje : Bada

Block/Survey No : 548/002

Type of Land : Government Estate

Land Use : Po. Kh. A

Field Name :

Other Details :

Old Block/Survey No :

Eligible Land Area Sq. M.	Ha. Aare.	Account Number / Area / Size of Occupiers Ha. Aare. Sq. M.	Note Numbers and Names
PO. Kh. Other 68-00 ----- ----- Total Area 68-00 Size Rs. 1.30 Joint and Special Duties Rs. 0.00 Water Portion Rs. 0.00	0- ---- 0-	----- 1146/0-68-00/1.30 (3721)	3155,4279,4348 GHCL Ltd
Details of the Survey		Details of Other Right and Encumbrances	
		3155 -----	

Village Sample No. 7

District : Kutch

(Promulgation Note No. 3155 Date 27/06/2017)

Taluk : Mandvi

Village/Moje : Bada

Block/Survey No : 459

Type of Land: Government Estate

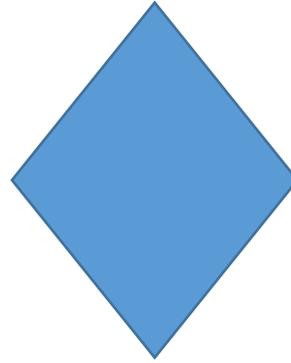
Land Use : Po. Kh. A

Field Name : Talawadi

Other Details :

Old Block/Survey No : 381

Old Survey No: 237,2126 Related Note Numbers



Eligible Land Area Aare. Sq. M.	Ha.	Account Number / Area / Size Names of Occupiers Ha. Aare. Sq. M.	Note Numbers and
PO. Kh. Other 3-02-29 ----- ----- Total Area 3-02-29 Size Rs. 0.00 Joint and Special Duties Rs. 0.00 Water Portion Rs. 0.00	---	----- 521/3-02-26 Sarkar(2125)	3155 Shri
Details of the Survey		Details of Other Right and Encumbrances	
		3155 -----	



सत्यमेव जयते

Government of
IndiaMinistry of Environment,
Forest and Climate Change

CLIMATE CHANGE AND THE VULNERABLE INDIAN COAST

R Ramesh | J R Bhatt



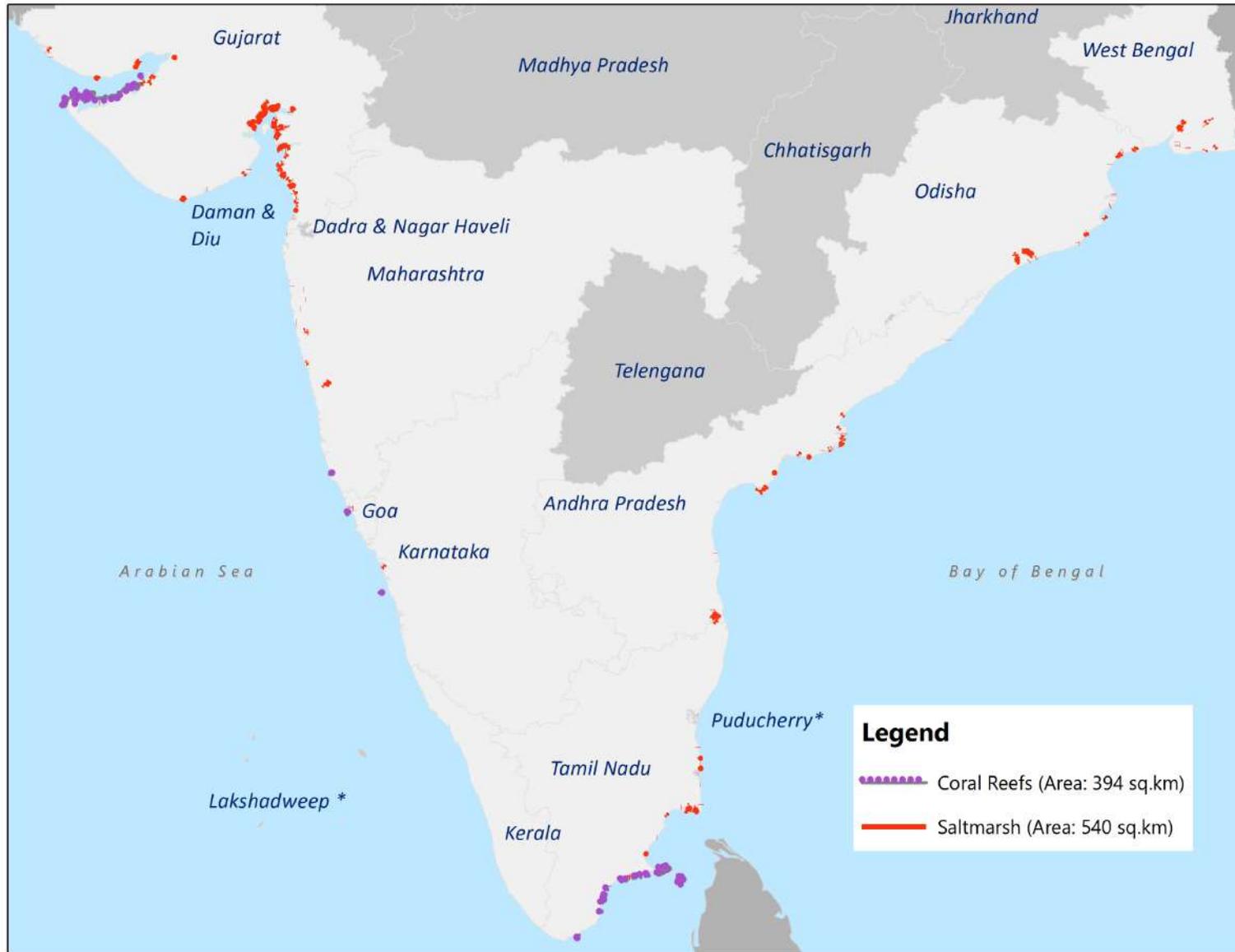


Figure 5: Coral reef and saltmarsh ecosystems of India

Legend

-  Coral Area
-  High Coral Area Southern Shoreline of GoK
-  Project Site GHCL





Coral Area

Legend

- High Coral Area Southern Shoreline of GoK
- Marine National Park
- Project Site GHCL



सत्यमेव जयते



जहाँ है हरियाली ।
कहाँ है खुशहाली ॥
Ministry of Environment and Forests
Government of India



Coral reefs in India

status threats and conservation measures

Editors

J R Bhatt
J K Patterson Edward
D J Macintosh
B P Nilaratna





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3. Reproduction, recruitment and restoration 4. Coral environment and threats.

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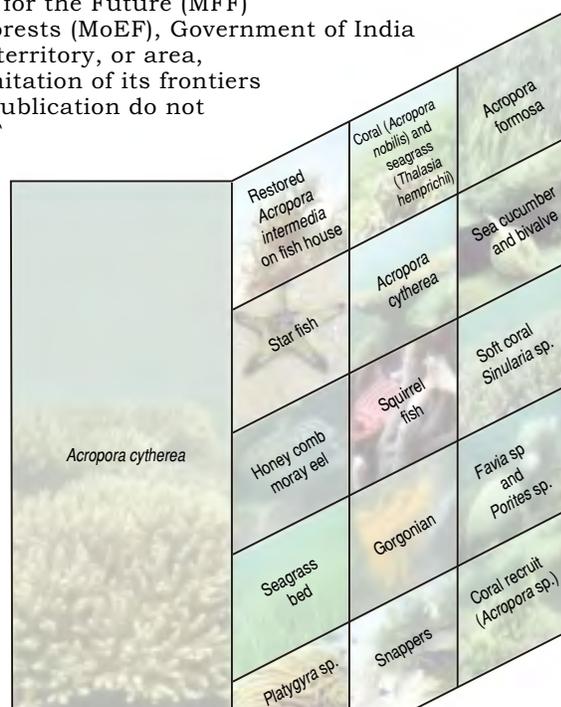
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Back : Coral assemblage
Photo by SDMRI

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J.K. Patterson Edward



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species of reef vegetation, which include green algae (37 species), red algae (26 species), brown algae (37 species) and sea grasses (3 species); 193 species of fishes (including bony/cartilaginous fish and prawns); and a variety of marine invertebrates like sponges (34 species), hydrozoans (5 species), jelly fish (3 species), sea anemones (4 species), zooanthids (7 species), flat worm (4 species) and echinoderm (8 species). (GEER Foundation, 2004). Unfortunately, the coastline of Gujarat is under pressure from natural and anthropogenic factors like cyclones, earthquakes, droughts, warm streams, industrialization and mining. All these factors have great potential to adversely affect corals and the associated flora and fauna of the reef ecosystems.

It must be noted here that the GOK has the first Marine Protected Area (i.e., Marine National Park and Sanctuary) of the country; this was established in the year 1982-83 covering a total area of 620.81 sq. km (GEER Foundation, 2004). Ecologically it mainly includes the islands and the intertidal zones along the coast. There are 42 islands in the Gulf of Kachchh which includes some submerged areas. Among these islands, some locations have been selected in order to analyze and study the coral reefs of the state.

Material and methods

The study area was divided into three different zones, viz. Eastern Gulf, Central Gulf and Western Gulf which included the islands Pirotan and Goose; Poshitra, and Chank; Narara and Kalubhar, respectively. All these islands are located on the southern shore of the Gulf of Kachchh (Fig. 1).

The study of the coral recruitment was carried out by laying 1x1 m quadrats



Coral recruit (*Favites* sp.) in Narara Island

in the study area. By keeping the quadrats parallel to the reef edge at different levels, the recruitment rate of newly recruited coral colonies was studied. The colonies, consisting of single, double and triple polyps, were considered as 'new recruits'. All live coral colonies having a size of less than 3 cm were also considered newly recruited colonies.

In order to identify the age of the coral reefs, a carbon dating technique was utilized by using an Ultra Low Level

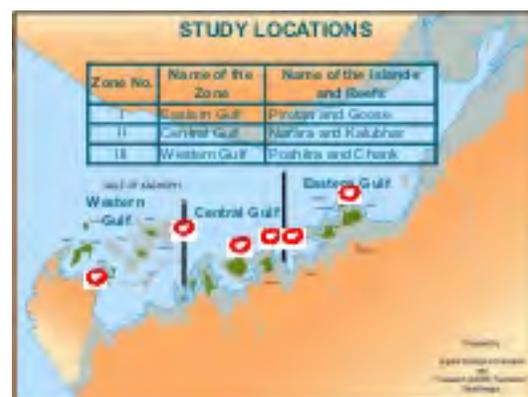


Fig. 1. Zones of the study area (Eastern, Central and Western Gulf)



ANNEXURE R/15

**CONSERVATION AND MANAGEMENT PLAN FOR SAND
DUNES**

PROPOSED GREENFIELD CHEMICAL COMPLEX

**VILLAGE BADA, TALUKA - MANDVI,
DISTRICT - KACHCHH, GUJARAT**

Final Report



Submitted to

GHCL Limited
GHCL House, Opp. Bada, H. No. 1, H. No. 2
Navrangpura, Ahmedabad - 380 015, Gujarat

Submitted by



Gujarat Institute of Desert Ecology
Opp. Changleshwer Temple, Mundra Road
Bhuj-370 001, Kachchh, Gujarat
www.gujaratdesertecology.com

JUNE 2022

FINDINGS OF THE STUDY

Status of Vegetation on Sand Dunes:

Presence of sand dunes in the study area suggests high energy wave dominated sea coast. These sand dunes are formed due to deposition of fine to medium, well sorted sand particles. Sediments of the dunes consist of windblown deposits of fine to very fine sand and silt.

The survey for sand dune has been done in the 10 km long stretch along the coast (5 km on either side). Around 18-20 different points have been surveyed along the 10 km stretch. Most of the sand dunes are covered with 70-80% dense grass vegetation while 20-30% sand area is covered with sparse vegetation. The density of *Prosopis juliflora* increases away from the sea.

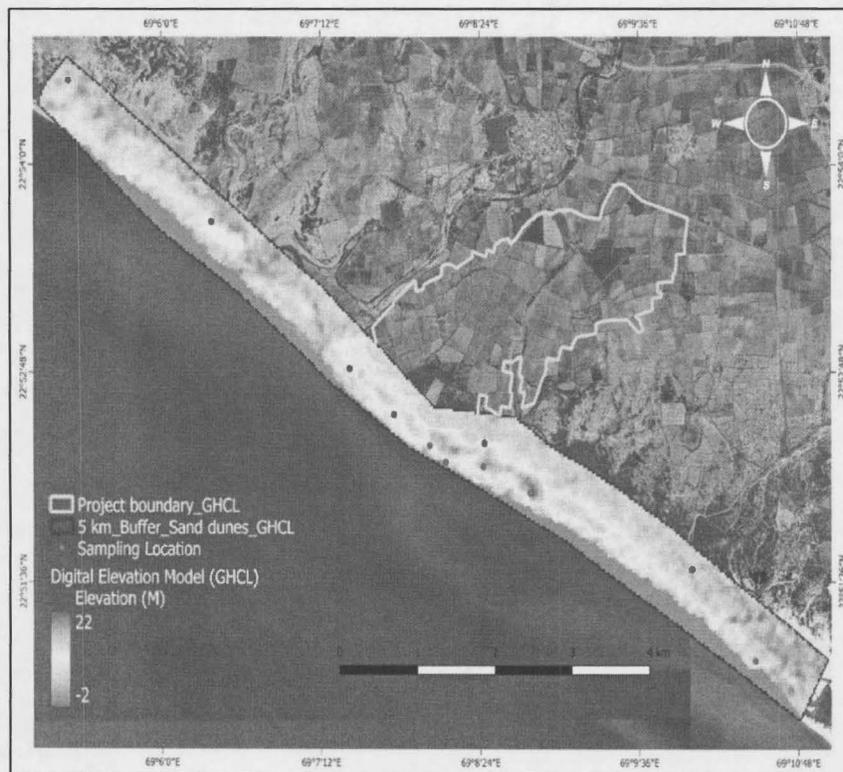


Figure 2. Digital Elevation Models of the Study Area and Sampling Location Around the Study Area

SAND DUNE CONSERVATION MEASURES

Conservation and management of natural ecosystem and habitat are the prime importance in recent time for ecological balance, natural flow of ecosystem services, conservation of biodiversity and our sustainable development. Sand dune are one among the threatened ecosystem which are critical in view of the recent developmental activities along the coastal areas all over the world.

Though the sand dune present in vicinity of the proposed project is very much stable sand dune system due to its vegetation cover except some cliff areas and minimum human interference or activities are observed in the area (due to the narrowness of the beach, lack of approachable roads, etc.). However, in the event of coastal development activities, increasing anthropogenic pressure and ongoing climate change, impact on the sand dune couldn't be neglected in future. Therefore, priority should be given for sand dune conservation and management measures may involve access way construction, signage and a community awareness program. It is applicable to the nearby coastal areas of GHCL Project area.

Therefore, some suitable measure and implementable action to be undertaken for conservation and management of the natural sand dune in the area which are as follows:

1. Erosion Control

The sand dune may face erosion threats due to high wind and tidal action prevailing in the area. The erosion of sand dune is likely in cliff areas facing towards the coastline due the lack of substantial vegetation. The coastal dunes are relying primarily on maintaining a uniform protective cover of suitable vegetation. Therefore, plantation of the cliff area is required with suitable native species of grasses, herbs and shrub which naturally grows on sand.

To provide sufficient plant cover to protect fragile dunes against wind erosion, species that are native to the coastal dunes are adapted to survive the hostile environment of drifting sand, strong winds, salt spray and infertile soils. The plantation activity may be promoted by using CBO (Community Based Organisation) or Forest Department They provides long term stability.

2. Sand Dune Restoration

Tropical storms are primarily responsible for the damage in many parts of the coastal dune ecosystem. Restoring vegetation on coastal dunes is important because vegetation helps stabilize dunes and provides essential habitat and food for many species of wildlife naturally dependent on sand dune. Therefore, key species of plants needs to be planted with coordinated efforts to restore degraded sites within the sand dune area.

3. Stabilising Sand Dune Through Re-vegetation (Sand Dune with Sparse or without Vegetation Cover)

Re-vegetation is a general term that includes stabilising a land surface with plants that need not be native. In coastal dune management the emphasis should be on regeneration; re-establishing a range of indigenous plants that would occur normally in the local environment. This is applicable in the areas or patches of sand dune where there is no vegetation or sparse vegetation. For this there is no need for removing existing vegetation from the dunes.

A healthy dune ecosystem will display a range of plant communities and locally indigenous species that reflect the geographical distribution of species along the coast, zonation within the dune system and the age of the dunes. These communities provide habitats for a diverse range of native fauna, providing them with resources such as food, breeding sites and protection from predators.

For the re-vegetation suitable seed collection is prime important and this can be done through selecting the target plants, establish their locations, understand their fruiting times and the logistics of gathering their seed. Collect local progeny from naturally occurring remnant vegetation as close as possible to the project site. To obtain good genetic quality for each species by collecting from healthy, vigorous plants. Further, it should be ensuring that plants and populations are not over exploited, and collect small amounts of seed from a large number of individual plants that are well separated from each other.

4. Plantation of Native Sand Dune Adopted Vegetation (Psammophytes):

Sand dunes are maintained with the help of sand dune vegetation as wind traps, sand binders of dune stabilizers. Dunes can be stabilized using indigenous grasses and

other plants which can help by “reducing the velocity of waves and absorbing their energy”. These plants take root and begin to form a strong, thick barrier which anchors the sand dune and helps keep sand in place. Planting takes an extensive amount of work to complete. First, indigenous plant seeds must be obtained, then site preparation, planting, fertilization, and mulching are required. Following the planting process, irrigation needs to be done in order to maintain required moisture level. Installing dune stabilization vegetation and structures is not the end of the process. The dune must be continuously maintained. Beach grasses are pioneer plants in stabilization of coastal sand dunes. They create an environment more attractive to other species of flora and thus encourages colonization by fauna subsequently changes the dune characteristic features. However, as the plants become established, the dune becomes more stable.

5. Fire Control and Management

Naturally occurring fires are not considered to be a regular feature of the coastal dune environment. It is recognised that active fire management may be required to reduce the risk of wildfire to life and property that has been built in the dune environment.

Though, the present sand dune area has no any sign of fire in present time, however, increasing human population in the event of plant establishment chance of fire cannot be neglected. Therefore, care should be taken to manage fire or fire management system needs to be installed, if fire occurs in future so that vegetation to be managed to conserve the dune environment.

6. Control of Invasive Species

Presently, most of the sand dune area has been covered by the *Prosopis juliflora*. Though, it acts as a sand stabiliser in the area, however, further, invasion of *P. juliflora* to be checked and focus to be given for the plantation or re-vegetation of native species for sand dune conservation.

7. Minimise Anthropogenic Activity in Coastal Ecosystem

Increased human activity such as recreational tourism, fishing, and coastal developmental activity, mainly the economic activities may degrade the dune stability and its ecosystem quality. Though, the major parts of the dune are covered

by the *P. juliflora* and minimum anthropogenic activities noticed during the survey, however, the rapid pace of developmental activities are undergoing in the entire coastal areas of Kachchh including the Mandvi coast, may degrade the ecosystem in future. Therefore, minimum human interference to be allowed in the dune and its sandy coast and focus to be given for awareness among various stakeholders about importance of dune ecosystem and conservation of sand dune.

8. Removal of Beach Debris

Removal of beach debris/waste from such area is an appropriate management practice to promote dunes in the project area. Accumulation of beach debris and other waste by wave action or by dumping leads to damage of dune vegetation and in course of time may affect further dune formations. Beach cleaning occurs in those locations with high levels of recreational use, especially near urbanizations. In addition to its adverse impact on the foreshore flora and fauna, it can exacerbate erosion. The only requirement in most cases is to cease the activity and allow dune vegetation to re-establish.

9. Conservation Education and Awareness Programme

It is normally observed that people have lack of knowledge and awareness about the importance of sand dune ecosystem for the environment and for the human being. Therefore, focus should be given in organizing activities, sign board and other awareness programme on the conservation of sand dune and its dependent fauna.

10. Monitoring and Evaluation

Regular monitoring and evaluation of the sand dune ecosystem and its floral and faunal composition is pre-requisite to manage the sand dune in future and in the event of establishing Greenfield complex by the M/S GHCL Ltd. through expert agencies.

Fund Allocation for Implementation of Conservation Plan

The successful conservation and protection of natural ecosystem/habitats is the prime duty of all stakeholders using the natural resources of such areas for their livelihood and economic development activity. The conservation measure suggested for the conservation sand dune present in the buffer area of the proposed project area of the GHCL is given in the previous section. Since, sand dune is a crucial ecosystem for some threatened wildlife species, special focus is required to ensure effective conservation measures to be implemented in future for conservation and restoration of the sand dune.

To implement the above-mentioned conservation measure for the sand dune, budget has been proposed (breakup given in table 4) for each activity to meet the goal of successful conservation of sand dune and its threatened biodiversity. The proposed estimated budget of Rs. 30,00,000/- (Rupees Thirty lakhs only) has been allocated for the upcoming 10 years from the date of inception of the project to implement various conservation actions as suggested in the previous section of the report.

In addition to the fund allocation made for conservation of sand dune in the buffer areas of the GHCL proposed project, environmental/ habitat improvement programmes could be undertaken as part of CSR activities focussing on the conservation of sand dune environment.

Table 4: Proposed budget for implementation for conservation measure

Sl. No.	Specific Conservation and Management Objective	Proposed Expenditure
		Long term (10 years)
1	Sand dune Conservation and Protection	6,00,000.00
2	Habitat Improvement & Plantation	7,00,000.00
3	Research and Monitoring	6,00,000.00
4	Conservation education & Awareness generation	4,00,000.00
	Total	23,00,000.00

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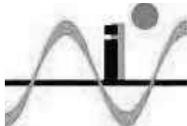
Studies on sand dune mapping and morphological changes of the river mouth at the proposed Greenfield Chemical Complex at District Kutch, Gujarat

Sponsored by: **GHCL, Limited Ahmedabad**

**GHCL House
Opp. Punjabi Hall
Navrangpura, Ahmedabad
380009**

Final report

August 2020



सीएसआईआर – राष्ट्रीय समुद्र विज्ञान संस्थान
CSIR-NATIONAL INSTITUTE OF OCEANOGRAPHY
 (वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)
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Contents

List of Figures	4
List of Tables	5
1. Introduction	6
2. Objectives and study area.....	6
3. Data and Methodology	7
3.1. Morphological changes of River mouth and sand dune analysis	7
3.2. Shoreline Analysis	8
3.3. Mapping of Suspended Sediment Concentration(SSC) at the selected points.....	9
4. Results and Discussion	11
4.1. Objective 1 - Morphological changes of Seasonal River Vengadi mouth and sand dune analysis.....	11
4.2. Objective 2 - Mapping of the sand dunes	16
4.3. Objective 3 - To find out the suitable passage for intake and outfall pipeline corridor	19
4.4. Objective 4 - Observation of Suspended Sediment Concentration (SSC).....	35
5. Conclusion and recommendations	42

List of Figures

Figure 2. 1 Study area.....	7
Figure 4.1.1 River Mouth dynamics from satellite imagery (a) 2008 - 2014 (b)2015-2018	13
Figure 4.1.2 Satellite imagery showing River Flow at the elevated region during high tide and excess water flow in the river	14
Figure 4.1.3 The direction of flow of the river during 1988,1990 and after 2005	15
Figure 4.2.1 Total dune area near the proposed site marked in the solid yellow line	17
Figure 4.2.2 Total Dune Area with the transects	18
Figure 4.3.1 Elevation of the Dune along with the project site boundary.....	20
Figure 4.3.2 Landfall points based on dune characteristics.....	22
Figure 4.3.3 Coastal bathymetry,landfall, intake,outfall points of the proposed site	23
Figure 4.3.4 Distance between intake and outfall points and the suggested landfall points for the proposed site	24
Figure 4.3.5 Dune passage to Landfall points and landfall points to suggested Intake and Outfall points passage.....	27

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Figure 4.3.6 Dune profiles from the coast to the project boundary.....	28
Figure 4.3.7 Transects for Shoreline Analysis	32
Figure 4.3.8 DSAS result of Shoreline Analysis near the proposed site	34
Figure 4.4.1 Satellite-derived SSC as on 22/11/2018 in the study region	36
Figure 4.4.2 Satellite-derived SSC values for the intake and outfall point for the years 1999-2003....	37
Figure 4.4.3 Satellite-derived SSC values for the intake and outfall point for ideal weather of 1999-2003	38
Figure 4.4.4 Satellite-derived SSC values for the intake and outfall point for pre-monsoon of 1999-2003	38
Figure 4.4.5 Satellite-derived SSC values for the Intake and Outfall point for Post-Monsoon of 1999-2003	39
Figure 4.4.6 Satellite-derived SSC values for the intake and outfall point for the years 2013-2018....	39
Figure 4.4.7 Satellite-derived SSC values for the Intake and Outfall point for ideal weather of 2013-2018	40
Figure 4.4.8 Satellite-derived SSC values for the intake and outfall point for pre-monsoon of 2013-2018	41
Figure 4.4.9 Satellite-derived SSC values for the Intake and Outfall point for Post-Monsoon of 2013-2018	41

List of Tables

Table 3.1 Data used for the study.....	8
Table 3.2 Satellite imagery acquisition dates for DSAS analysis.....	8
Table 3.3 Data Used to retrieve SSC	10
Table 4.1 Details of transects in the dune area for the proposed pipeline corridor	25
Table 4. 2 Shoreline Transect characteristics	30

1. Introduction

M/s. GHCL, Ahmedabad, is a diversified company with the business area in heavy chemicals, textiles, and consumer products. The major business is from Soda Ash and Sodium bicarbonate manufacturing at Sutrapda, District Gir Somnath, Gujarat. It is one of the leading producers of Soda ash in the country since 1988.

Soda ash and Sodium bicarbonate is having huge demand and has application in the consumer industry. To meet the growing demand, GHCL proposes to set up a Greenfield chemical Complex near Village Bada, District, Kutch, Gujarat.

The Greenfield chemical complex will comprise of Light and Dense Soda ash manufacturing plants, Sodium bicarbonate manufacturing plant, Captive co-generation power plant, seawater intake, and effluent disposal system and associated infrastructure. In future company at the same complex may go in for Caustic soda and by-products like Chlorine, Hypo, Hydrogen, etc.

The Soda ash manufacturing being an exothermic process, requires a huge quantity of seawater for cooling and sweet water for process requirement. The proposed project site is in proximity to Arabian sea-coast off village Bada.

GHCL engaged CSIR - National Institute Oceanography (NIO), Goa for carrying out the morphological studies of the dunes near project location through which seawater intake and effluent disposal are planned.

CSIR- NIO as a Premier research institute of Oceanography in the Indian Ocean region has carried out many projects of this kind in the past. NIO has got the best talents of the world on various aspects of fundamental as well as applied oceanography fields. The objectives of the project after the discussion in the meeting are as follows.

2. Objectives and study area

- a) To map and analyse the morphological changes of the seasonal river 'Vengadi' discharge mouth close to the proposed project site towards southwest for ten years at three seasons based on the archived satellite data.
- b) Mapping of the sand dunes if any at the proposed site.

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- c) To find out and recommend the suitable passage for seawater intake and effluent outfall pipeline corridor at the proposed location.
- d) Observation of Suspended Sediment Concentration (SSC) at the recommended seawater intake points identified by CSIR –NIO, RC, Mumbai.



Figure 2.1 Study area

3. Data and Methodology

3.1. Morphological changes of the river mouth and sand dune analysis

The seasonal river Vengadi discharge mouth lies towards the southwest of the proposed complex and sand dune towards the south of the project boundary(Figure 2.1). Archived satellite imagery (Table 3.1) was used for the study area to address morphological changes of the river mouth in the study region. The latest satellite image on 30-09-2018 was used for mapping the present extent of a sand dune. That extent was used further for detailed analysis to find out the suitable passage for intake and outfall pipeline corridor. All data products were

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procured either from the National Remote Sensing Centre (NRSC), Hyderabad or downloaded from earth explorer website. The details of the data products used in the study are below.

Table 3.1 Data used for the study

Year	Satellite / Sensor	Spatial resolution (m)
2008 – 2011 (4 years)	Landsat 5 / TM	30
2013 – 2018 (6 years)	Landsat 8 / OLI	

Satellite images were processed for three temporal periods as below within a year based on tidal conditions at the study site. The three temporal periods are as follows:

Period 1 – January / February

Period 2 – March / April / May

Period 3 – October / November / December

All the satellite images were visually observed and processed in software, and the river mouth morphology was analysed. Based on the analysis, the stability of the river mouth, dynamics of the sand spit and beach around that river was understood. After demarcating the entire dune stretch, elevation values (GIS files) for identified plant land and the adjoining area towards the sea which were provided by GHCL are overlaid on the dune extent. It provided the 3D extent of the whole dune stretch. This combination of elevation and areal extent of the dune helped to explore the potential passages in that dune area for the pipeline corridor.

3.2 Shoreline Analysis

The Digital Shoreline Analysis System (DSAS) for GHCL project was carried out with 28 shorelines, from the year 2008 to 2018 in 3 seasons. Due to the lack of satellite data and different tide levels, the year 2012 was ruled out. One season of years 2013 and 2016 were also ruled for the same reason. The shorelines were digitized using the appropriate GIS software from the below data (Table 3.2). This exercise brought out the stability of Bada coast where landfall points will be falling.

Table 3.2 Satellite imagery acquisition dates for DSAS analysis

Acquisition date	Satellite / Sensor	Spatial resolution (m)
16/04/2008	Landsat - 5 / TM	30
25/10/2008		

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28/12/2008		
14/02/2009		
05/05/2009		
29/11/2009		
16/01/2010		
06/04/2010		
02/12/2010		
03/01/2011		
08/03/2011		
25/04/2011		
30/04/2013		
23/10/2013		
11/01/2014		
01/04/2014		
10/10/2014		
14/01/2015		
20/04/2015		
29/10/2015		
17/01/2016		
06/04/2016		
19/01/2017		
25/04/2017		
03/11/2017		
07/02/2018		
14/05/2018		
06/11/2018		
10/02/2019		

Landsat - 8 / OLI

3.3 Mapping of Suspended Sediment Concentration(SSC) at the selected points

The Suspended Sediment Concentration (SSC) was derived for the years 1999-2003 and 2013-2018 using two different sensors ETM+ and OLI from the intake location suggested by Regional Center, CSIR-NIO, Mumbai. The details of the data used are

below (Table 3.3). The Suspended Sediment Concentration (SSC) was derived from Landsat ETM+ and OLI images through single band algorithm (Nechad et al. 2010). After estimating the SSC values for the study region, the values for intake and outfall points were retrieved and plotted. The recommended seawater intake and effluent disposal locations at Arabian sea by CSIR-NIO, Mumbai are as :

Seawater Intake: 22 52' 01.07" N, 69 07' 28.9" E, 22 51' 57.44" N, 69 07' 32.44" E

Effluent Disposal: 22 52' 15.79" N, 69 06' 14.35" E, 22 52' 6.65" N, 69 05' 59.08" E

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Table 3.3 Data Used to retrieve SSC

<i>Sl. No</i>	<i>Acquisition Date</i>	<i>Sensor</i>	<i>Path/Row</i>	<i>Spatial resolution (m)</i>
1	26/11/1999	ETM+	151/44	30
2	14/02/2000	ETM+	151/44	
3	18/04/2000	ETM+	151/44	
4	27/10/2000	ETM+	151/44	
5	28/11/2000	ETM+	151/44	
6	15/01/2001	ETM+	151/44	
7	05/04/2001	ETM+	151/44	
8	21/04/2001	ETM+	151/44	
9	18/01/2002	ETM+	151/44	
10	19/02/2002	ETM+	151/44	
11	02/11/2002	ETM+	151/44	
12	05/01/2003	ETM+	151/44	
13	21/01/2003	ETM+	151/44	
14	14/04/2013	OLI	151/44	
15	30/04/2013	OLI	151/44	
16	16/05/2013	OLI	151/44	
17	23/10/2013	OLI	151/44	
18	08/11/2013	OLI	151/44	
19	24/11/2013	OLI	151/44	
20	11/01/2014	OLI	151/44	
21	12/02/2014	OLI	151/44	
22	01/04/2014	OLI	151/44	
23	19/05/2014	OLI	151/44	
24	10/10/2014	OLI	151/44	
25	11/11/2014	OLI	151/44	
26	27/11/2014	OLI	151/44	
27	30/01/2015	OLI	151/44	
28	20/04/2015	OLI	151/44	
29	15/10/2016	OLI	151/44	
30	31/10/2016	OLI	151/44	
31	16/11/2016	OLI	151/44	
32	19/01/2017	OLI	151/44	
33	20/02/2017	OLI	151/44	
34	09/04/2017	OLI	151/44	
35	24/04/2017	OLI	151/44	
36	03/11/2017	OLI	151/44	
37	19/11/2017	OLI	151/44	
38	22/01/2018	OLI	151/44	
39	07/02/2018	OLI	151/44	
40	12/04/2018	OLI	151/44	
41	28/04/2018	OLI	151/44	
42	06/11/2018	OLI	151/44	
43	22/11/2018	OLI	151/44	

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4.2. Objective 2 - Mapping of the sand dunes

The entire area of the dune outside the project boundary are falling in between Vengadi and Panchatiya seasonal rivers(Figure 4.2.1). The approximate area of this long dune is 302 ha. A total of 342 transects with a spacing of 20 m were used to analyse the physical characteristics of the dune area. The dune extends from northwest to southeast for a length of approx.6.8 km. The maximum observed width of the dune was 821 m at transect ID:204, and the minimum observed width is 7 m transect ID:1(Figure 4.2.2). Entire dune area was computed for its width and its proximity with the project site, and the proposed landfall points.



Figure 4.2.1 Total dune area near the proposed site marked in the solid yellow line

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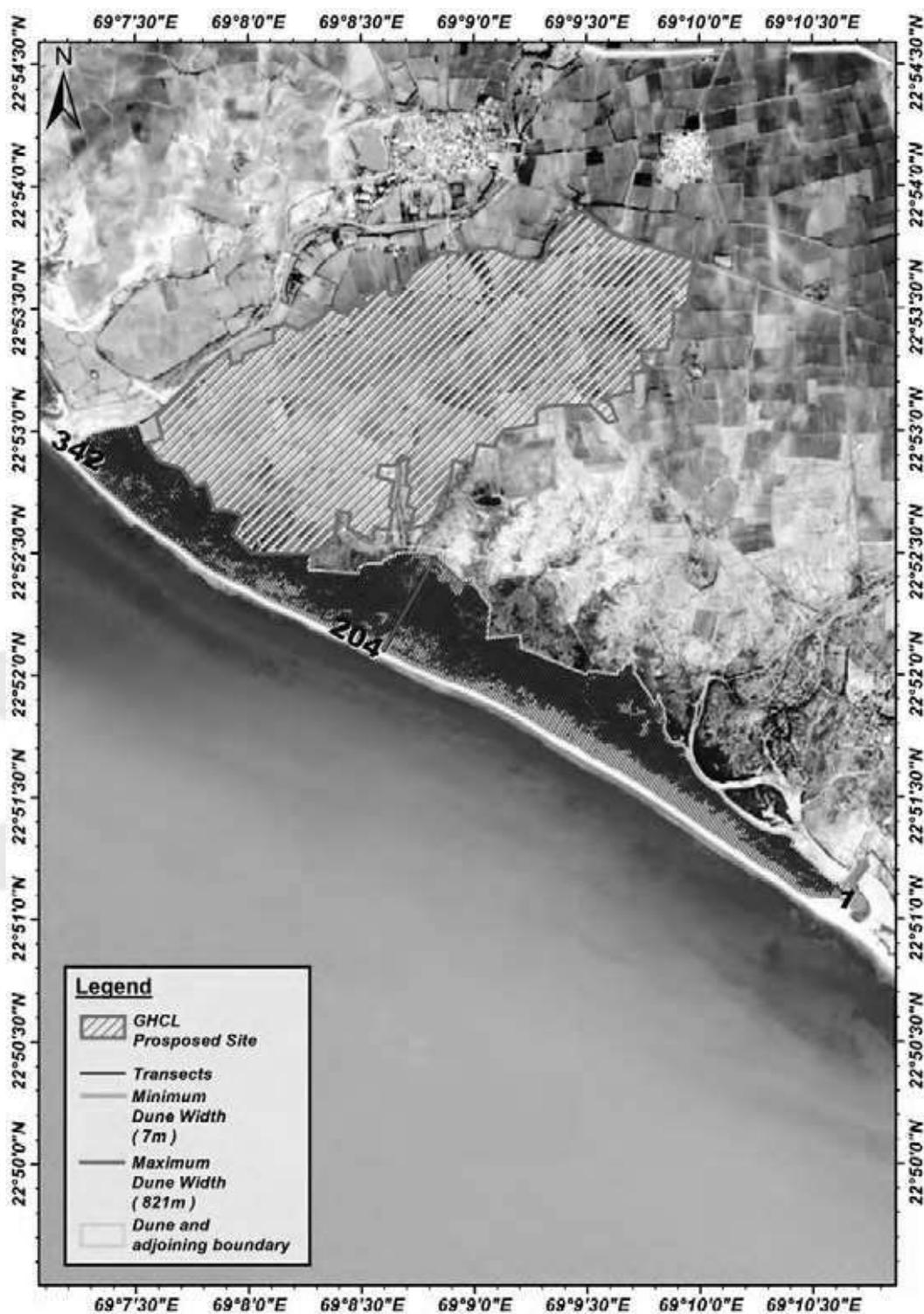


Figure 4.2.2 Total dune area with the transects

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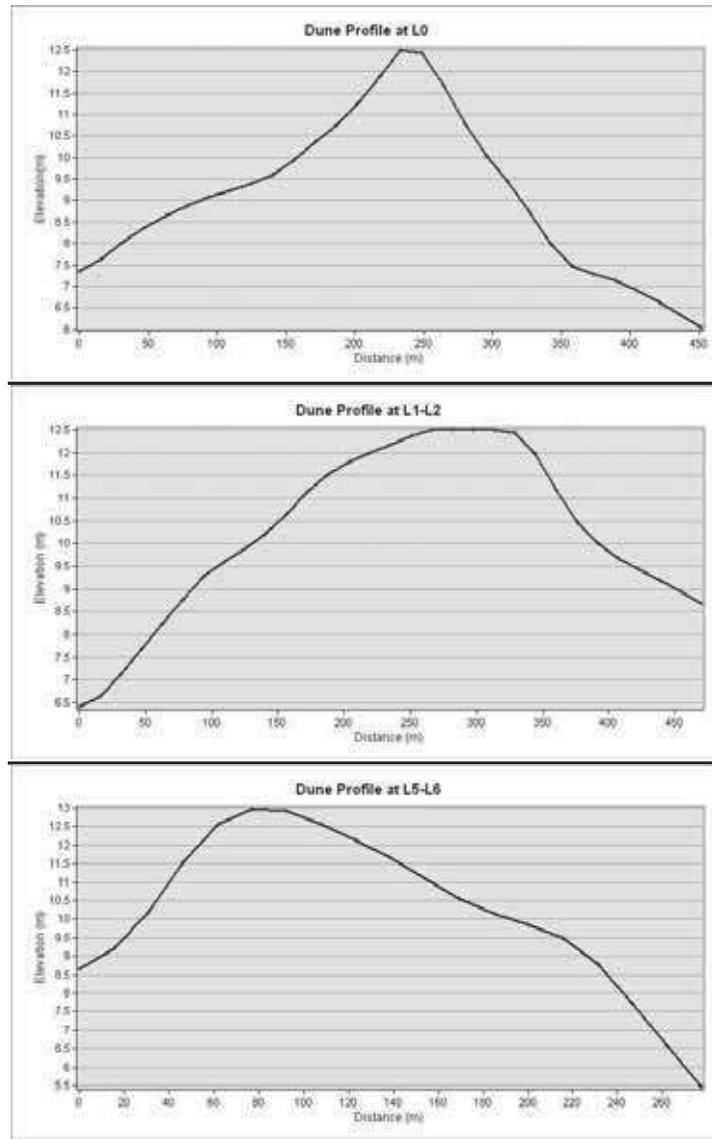


Figure 4.3.6 Dune profiles from the coast to the project boundary

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5. Conclusion and recommendations

- The Vengadi river discharge mouth, which was considered for the pipeline corridor, has not undergone significant morphological changes from 2008 to 2018.
- This study exhibits that the river mouth opened up only in the years 1988 and 1990, but the reasons could not be ascertained. After the construction of the tidewater barrier in 2005 across the river, river mouth has not been breached either by river water or by tides.
- Due to this, the river mouth is so stable that there is no inflow or outflow through this mouth observed. Hence, the option of considering this river mouth for laying the buried pipelines may be considered if dredging of the mouth is approved by the concerned authorities during the construction stage. It may refill again, as evidenced in the past. The risk of pipelines exposed may not be ruled out in case of any natural disaster, where appropriate precautionary measures should be taken at the planning stage. In this option, the outfall points are at 2045m and 2568m distance in the sea from the river mouth. But, the problems of bringing the pipelines upto the river mouth need to sort out.
- The economics of laying longer pipelines and two tunnelling in the dune stretch may be considered, and the optimum decision may be taken. As the shorter distance points (L0, L0(1), L1, L2, L5, L6) are available, it is recommended to prefer those points.
- The approximate area of this dune stretch is 302 ha. The dune extends from northwest to southeast for a length of 6.8 km without any break. If there would have been a break, it could have been used as a natural passage. The maximum observed width of the dune was 821 m, and the minimum observed width is 7 m. Dune height extends from 1.5 m to 18.5 m. Three different patches of dune reach up to 18.5 m.
- It is observed through digitization of historic shoreline that no significant erosion has occurred along the entire stretch of the Bada coast. This indicates that this coast has been stable for a long time. The proposed LF points are lying on the stable coast of this region.
- Based on the dune characteristics, vicinity of the project site, intake and outfall points, the stability of the coast, ten transects and corresponding landfall points were

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analysed individually. Based on this, L5 & L6 may be the better landfall points for the suggested intake and L0,L0(1), L1&L2 for outfall points. Intake point is around 1005 & 1007 m, outfall is around 2185 & 2686 m from L0 & L0(1), and 2371 & 2865 m away from L1&L2 respectively. Dune width is about 275 m from the L5 to the project plot boundary. Dune width is 425m, 425m, 466m and 466m in between the L0(1), L0, L1 & L2 respectively, to the plot boundary. The corresponding transects T01, T02, T1, T2, T5&T6, may be explored in detail for the alternate means of laying the pipeline such as tunnelling, etc.

- The minimum and maximum range of SSC at the intake point was 2.48 mg/l and 27.12 mg/l respectively during 1999-2003. The variations of SSC at intake point is due to various reasons. Values of SSC should be considered while planning the seawater intake and effluent disposal system.
- GHCL may conduct proper EIA study for predicting and mitigating impacts due to project activities and take all necessary environmental approvals from state and central environmental authorities for the project.

-----End of the Document -----



GHCL Limited

Date: 29/11/2022

To,
Director(Environment) & Member Secretary,
Gujarat Coastal Zone Management Authority (GCZMA)
 Forest & Environment Department,
 Gandhinagar, Gujarat

Subject: Reply of Additional details required for CRZ Clearance for Greenfield Chemical Complex Seawater Intake and Effluent disposal facilities at Village- Bada, ta- Mandavi
Ref.: Email from GCZMA dated on 01/02/2022 (Annexure-1)

Respected Sir,

	Suggestion	Answer
1.	Submit final EIA report.	It is requested to note that Final Environment Impact Assessment Report with Public hearing minutes and Action plan has been submitted to Ministry of Environment, Forest and Climate Change. Acknowledgment Slip, Final EIA Report and Report of Part-C which is generated after Final EIA submission is attached as Annexure-2 .
2.	Submit Public Hearing details.	It is requested to note that the public hearing was completed on 17-10-2022 at 11.00 Hrs. Venue: Project Site, Survey no . 432, Village: Bada, Taluka: Mandvi, District: Kutch, Gujarat. Public hearing minutes is attached as Annexure-3 and the same have been forwarded to MOEFCC.
3.	Forest land involve in the proposed project, submit status of Forest Clearance.	It is requested to note that there is no forest land within the boundary of proposed project site. However, some part of the unclassed forest area located south of the project site outside boundary. Sea water intake and outfall pipeline will pass through underground micro tunnel in specific corridor to cross forest area. M/s GHCL has applied to MoEF & CC for Forest Diversion of 0.9689 Ha. of un-class forest land vide' proposal no. FP/GJ/Others/147527/2021. The Current status of Forest Clearance application is pending at State level. Proof of status and Forest clearance application is attached as Annexure-4 .
4.	Submit Olive Ridley Turtle conservation plan approved from Forest Department.	GHCL Ltd have submitted Conservation Plan for Olive Ridley Turtle to CWLW department of Gujarat. Conservation plan prepared by Zoological Survey of India and Dr Bharat Jethava – QCI NABET approved expert as well as Submission proof are attached as

M.V. SJI 2022
 Forest & Environment Deptt.
 Govt. of Gujarat Sachivastaya
 Nav Sahyadri, Gandhinagar

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GHCL Limited

		Annexure-5.
5.	Submit sand dunes conservation plan	Conservation plan of Sand Dunes is prepared by CSIR- National Institute of Oceanography, Mumbai which is attached as Annexure-6.
6.	Based on submission of above details team of official will visit the site.	Noted.

We kindly request you to consider the same and do the needful for CRZ Clearance to our above stated project proposal

Thanking You.
Yours truly,

For, M/s. GHCL Ltd

Enclosure:

- Annexure-1 Email dated 01/02/2022
- Annexure-2 Part-C, Final EIA Report and Acknowledgement Slip of Final EIA submission
- Annexure-3 Public Hearing Minutes
- Annexure-4 Forest Clearance application and its status
- Annexure-5 Conservation plan of Olive Ridley Turtle and its submission proof
- Annexure-6 Conservation plan of Sand dunes

GHCL Limited

Date: 26/12/2022

To,
Director (Environment) & Member Secretary,
Gujarat Coastal Zone Management Authority (GCZMA)
Forest & Environment Department,
Gandhinagar, Gujarat

Subject: Request to visit proposed project site by officials of Gujarat Coastal Zone Management Authority (GCZMA) for site Inspection as part of ADS sought on 01-02-2022.

Respected Sir,

We have applied for CRZ clearance for Intake and Outfall facility in CRZ area according to CRZ Notification for the "Greenfield Chemical Complex" of M/s. GHCL Limited dated on 11th October 2021. The Presentation for CRZ clearance was done on 17th January, 2022 and ADS were sought after presentation on 1st February 2022 and reply of the same has been submitted to your office on 29th November, 2022 along with Final EIA report.

As a part of ADS sought on 01-02-2022 by GCZMA, the officials of the Gujarat Coastal Zone Management Authority (GCZMA) can visit the proposed project site for inspection. So please arrange the Visit to the Proposed Project Site.

Thanking You.
Yours truly,

For, M/s. GHCL Ltd

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GHCL Limited

o/c



Date : 29.04.2023

To,
 Director (Environment) & Member Secretary
 Gujarat Coastal Zone Management Authority (GCZMA)
 Forest & Environment Dept.
 Sachivalay, Gandhinagar

Subject : Submission of requisite documents for CRZ clearance

Ref : 1. Application for obtaining CRZ Recommendations on date: 11/10/2021
 2. Email from GCZMA for additional details for CRZ Clearance on date: 01/02/2022
 3. Reply of Additional details required for CRZ Clearance date: 29/11/2022
 4. Request letter to visit proposed project site on date: 26/12/2022

Respected Sir,

We have applied for CRZ clearance for laying Intake and Outfall facility for the "Greenfield Chemical Complex" at Village-Bada, Taluka-Mandvi of M/s. GHCL Limited dated on 11th October 2021. The Presentation for CRZ clearance was scheduled on 17th January, 2022 and ADS were sought after presentation on 1st February 2022. The documents which were sought after presentation are listed below and same are attached as Annexure:

- Final EIA Report
- Public Hearing Details
- Schedule I species Conservation plan approved from Forest department
- Sand dunes conservation plan

Therefore we request you to acknowledge the enclosed documents and please grant us CRZ Clearance.

Yours respectfully,

For GHCL Ltd.

Authorized Signatory

29/4/23

Clerk

Forests & Environment Dept
 Govt. of Gujarat Sachivalaya
 New Sachivalaya, Gandhinagar

GHCL House, Swastik Society, Opp. Punjabi Hall, Navrangpura, Ahmedabad, Gujarat-380009, India Ph. : +91-079-26434100
 CIN : L24100GJ1983PLC006513, E-mail : ghclinfo@ghcl.co.in, Website : www.ghcl.co.in

Head Office: GHCL House, B-38, Institutional Area, Sector - 1, Noida, Uttar Pradesh - 201301, India Ph. : +91-120-2535335, 2358000, Fax : +91-120-2535209



Scanned with

Offshore Micro Tunneling Animation - Seawater Intake Of Mokran Petrochemical Complex Ani...





रजिस्ट्री सं० डी० एल०-33004/99

REGD. NO. D. L.-33004/99



भारत का राजपत्र

The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (i)

PART II—Section 3—Sub-section (i)

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं. 288]

नई दिल्ली, बुधवार, जून 1, 2011/ज्येष्ठ 11, 1933

No. 288]

NEW DELHI, WEDNESDAY, JUNE 1, 2011/JYAISTHA 11, 1933

पर्यावरण और वन मंत्रालय

अधिसूचना

नई दिल्ली, 1 जून, 2011

सा.का.नि. 424(अ).—केंद्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :-

- (1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) (चौथा संशोधन) नियम, 2011 है।
- (2) ये राजपत्र में उनके प्रकाशन की तारीख को प्रवृत्त होंगे।

2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची-1 में, विद्यमान क्रम संख्या 75, "सोडा क्षार उद्योग" और इससे संबंधित प्रविष्टियों के स्थान पर निम्नलिखित क्रम संख्यांक और प्रविष्टियां रखी जाएंगी, अर्थात् :-

क्र. सं.	उद्योग	पैरामीटर	मानक
(1)	(2)	(3)	(4)

"75

सोडा क्षार उद्योग

बहिस्त्राव मानक

क. सॉल्वे प्रक्रिया

सान्द्रण सीमा मि.ग्रा/लीटर में, पी एच तापमान और बायोएस्से परीक्षण को छोड़कर

खाड़ी	समुद्रीय तटीय जोन	नदी मुख क्षेत्र	अन्तर्देशीय सतही जल	
निलंबित कण	500*	1000**	200	100
अमोनिकल नाइट्रोजन, N के रूप में	50	50	50	30
तेल और ग्रीस बायोएस्से***	5	5	5	5
पी एच	100 प्रतिशत बहिस्त्राव में 96 घण्टे के बाद 90 प्रतिशत मछलियां अवशेष			6.5-9.0
तापमान	प्रापक जल निकाय के परिवेशीय तापमान से 5°C से अधिक नहीं			

2

THE GAZETTE OF INDIA : EXTRAORDINARY

[PART II—SEC. 3(i)]

(1)	(2)	(3)	(4)
			*खाड़ी में अवजल निस्तारण बिन्दु निम्न भाटा रेखा के बाद रहेगा ।
			**बहिस्त्राव प्रसारक व्यवस्था तटीय विनियमन क्षेत्र अधिसूचना, 2011 के अनुरूप निम्न भाटा स्तर से न्यूनतम पांच मीटर की गहराई पर लगाई जाए तथा अवजल का निर्गम वेग तीन मीटर/सेकण्ड से अधिक हो ।
			***बायोएस्से परीक्षण IS : 6582-1971 के अनुसार संचालित किया जाए ।

ख. दोहरी प्रक्रिया

अंतर्देशीय सतही जल

पी एच	6.5-9.0
अमोनिकल नाइट्रोजन, N के रूप में	50
नाइट्रेट नाइट्रोजन, N के रूप में	10
साइनाइड, CN के रूप में	0.2
हेक्सावैलन्ट क्रोमियम	0.1
कुल क्रोमियम	2
निलंबित ठोस	100
तेल और ग्रीस	10

ग. स्टार्म वाटर

टिप्पण :

- स्टार्म वाटर को औद्योगिक बहिस्त्राव अथवा तलधुलाई बहिस्त्राव के साथ मिलाने के लिए अनुज्ञात नहीं किया जाएगा ।
- उद्योग की अंतसीमा के स्टार्म वाटर को वर्षा के 10 मिनट की संग्रहण क्षमता (घंटे का औसत) के एच डी पी ई परत वाले गद्दों के माध्यम से अलग नाली/नालियों से बहाया जाएगा " ।

[फा. सं. क्यू-15017/42/2009-सी.पी.डब्ल्यू]

रजनीश दुबे, संयुक्त सचिव

टिप्पण :—मूल नियम भारत के राजपत्र में सं. का.आ. 844(अ) तारीख 19 नवम्बर, 1986 के द्वारा प्रकाशित किए गए थे और पश्चातवर्ती सं. का.आ. 433(अ) तारीख 18 अप्रैल, 1987; सा.का.नि. 97(अ) तारीख 18 फरवरी, 2009; सा.का.नि. 149(अ) तारीख 4 मार्च, 2009; सा.का.नि. 512(अ) तारीख 9 जुलाई, 2009; सा.का.नि. 543(अ) तारीख 22 जुलाई, 2009; सा.का.नि. 595(अ) तारीख 21 अगस्त, 2009; सा.का.नि. 794(अ) तारीख 4 नवम्बर, 2009; सा.का.नि. 826(अ) तारीख 16 नवम्बर, 2009; सा.का.नि. 01(अ) तारीख 1 जनवरी, 2010; सा.का.नि. 61(अ) तारीख 5 फरवरी, 2010; सा.का.नि. 485(अ) तारीख 9 जून, 2010; सा.का.नि. 608(अ) तारीख 21 जुलाई, 2010; सा.का.नि. 739(अ) तारीख 9 सितम्बर, 2010; सा.का.नि. 809(अ) तारीख 4 अक्टूबर, 2010; सा.का.नि. 215(अ) तारीख 15 मार्च, 2011; सा.का.नि. 221(अ) तारीख 18 मार्च, 2011 और सा.का.नि. 354(अ) तारीख 2 मई, 2011 द्वारा संशोधन किए गए ।

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 1st June, 2011

G.S.R. 424(E).—In exercise of the powers conferred by Sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely :—

- (i) These rules may be called the Environment (Protection) (Fourth Amendment) Rules, 2011.
(ii) They shall come into force on the date of their publication in the Official Gazette.
- In the Environment (Protection) Rules, 1986, in Schedule I, in existing serial number 75, relating to "Soda Ash Industry", for the existing entries relating thereto the following serial number and entries shall be substituted, namely :—

[भाग II-खण्ड 3(i)]

भारत का राजपत्र : असाधारण

3

Sl. No.	Industry	Parameter	Standard			
(1)	(2)	(3)	(4)			
75	Soda Ash Industry		Effluent standards			
			A. Solvay Process			
			Limiting Concentration in mg/l except for pH, Temperature and Bio-assay			
			Creek	Marine Coastal Zone	Estuary Area	Inland Surface Water
		Suspended Solids	500*	1000**	200	100
		Ammonical Nitrogen as N	50	50	50	30
		Oil & Grease	5	5	5	5
		Bio-assay***	Minimum 90% survival of fish after 96 hours in 100% effluent			
		pH	6.5-9.0			
		Tempertaure	Not to exceed 5°C above the ambient temperature of the receiving water body			
			* The effluent discharge point in creek shall be beyond low tide line.			
			**The diffuser system shall be located in conformity with the Coastal Regulation Zone Notification, 2011 at a minimum depth of 5 metres below low tide level and with exit velocity for effluent more than 3 metres/sec.			
			*** The Bio-assay test shall be conducted as per IS : 6582-1971.			

B. Dual Process

Inland Surface water

pH	6.5-9.0
Ammonical Nitrogen, as N	50
Nitrate Nitrogen, as N	10
Cyanide, as CN	2
Hexavalent Chromium	0.1
Total Chromium	2
Suspended Solids	100
Oil & Grease	10

C. Stormwater**Note :**

- Stormwater shall not be allowed to mix with effluent and/or floor washings.
- Stormwater within battery limit of industry shall be channelized through separate drain(s) passing through HDPE lined pit(s) each having holding capacity of 10 minutes (hourly average) of rainfall for its catchment area."

[F. No. Q-15017/42/2009-CPW]

RAJNEESH DUBE, Jt. Secy.

Note: —The principal rules were published in the Gazette of India vide number S.O. 844(E), dated the 19th November, 1986; subsequently amended vide S.O. 433(E), dated the 18th April, 1987; and recently amended vide G.S.R. 97(E), dated the 18th February, 2009; G.S.R. 149(E), dated the 4th March, 2009; G.S.R. 512(E), dated the 9th July, 2009; G.S.R. 543 (E), dated the 22nd July, 2009; G.S.R. 595(E), dated the 21st August, 2009; G.S.R. 794 (E), dated the 4th November, 2009; G.S.R. 826(E), dated the 16th November, 2009; G.S.R. 01(E), dated the 1st January, 2010; G.S.R. 61(E), dated the 5th February, 2010; G.S.R. 485(E), dated the 9th June, 2010; G.S.R. 608 (E), dated the 21st July, 2010; G.S.R. 739 (E), dated the 9th September, 2010; G.S.R.809(E), dated the 4th October, 2010; G.S.R. 215(E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; and G.S.R. 354(E), dated the 2nd May, 2011.

[Colly]



CSR Initiatives for Greenfield Project



Outline of the CSR

1. Profile Of Villages
2. Health Initiatives
3. Education Initiatives
4. Livelihood Support Initiatives
5. Women Empowerment Initiatives
6. Community Development Initiatives
7. Environmental & Sustainability Initiatives

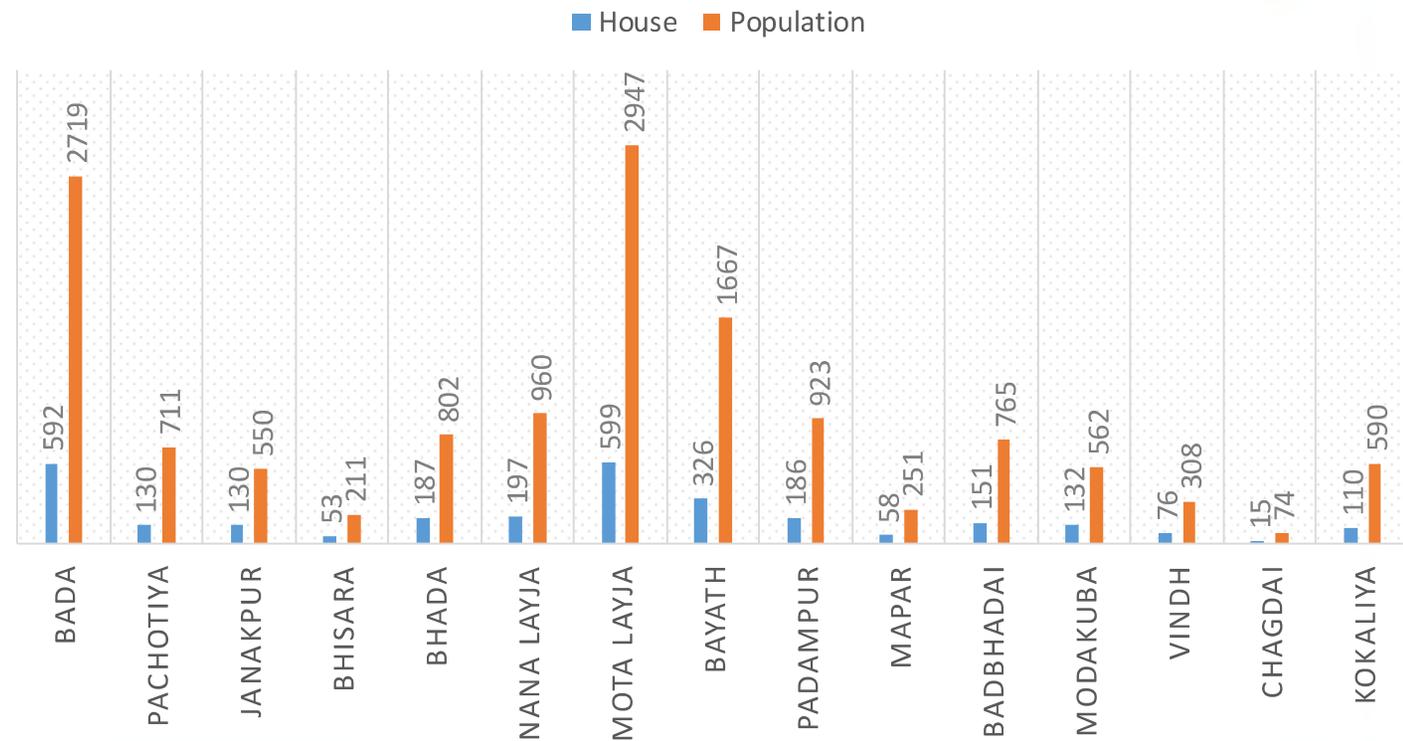
Total CSR spending data

Sr. No.	FY year	Spending in Cr.
1	FY-2021/22	1.53
2	FY-2022/23	0.97
3	FY-2023/24	2.64
4	FY-2024/25	2.40 (till Jan-25)
Total		7.54



Profile of Villages

Sr.No	Name of Village	House	Population
1	Bada	592	2719
2	Pachotiya	130	711
3	Janakpur	130	550
4	Bhisara	53	211
5	Bhada	187	802
6	Nana Layja	197	960
7	Mota Layja	599	2947
8	Bayath	326	1667
9	Padampur	186	923
10	Mapar	58	251
11	Badbhadai	151	765
12	Modakuba	132	562
13	Vindh	76	308
14	Chagdai	15	74
15	Kokaliya	110	590
Total		2942	14040





Health Initiatives

- Enhancing Healthcare Access in Needed Communities



Mobile Health Unit (MHU) Outreach

- GHCL foundation's initiative includes a MHU that visits twice a week, providing vital healthcare services directly to remote villages.
- Health Services Provided by MSU are free of cost promoting health equity.
- 700–800 patients benefit every month.

Health Awareness Program

- Our aim is to create TB-free villages.
- Programs held in villages to raise awareness of health.
- Organize health camps and seminars to educate the community about various health issues, prevention methods, and healthy lifestyles.
- Overall well-being of the community and demonstrate its commitment to corporate social responsibility

• Respect

• Trust

• Ownership

• Integrated Team Work



Education Initiatives

- Empowering Communities Through Education Support Programs



Efforts to Reduce Dropout Rates

- Implementing initiatives to decrease dropout rates from Anganwadi to High School levels through targeted ideas like parent awareness programs.
- Implementing programs to ensure continuous education from Anganwadi to high school reduces student dropout rates.



Support and Training Across Levels

- Providing support and training to 389 Anganwadi children, 1197 primary school children, and 337 high school students, enhancing their learning outcomes.



Education Initiatives

- Empowering Communities Through Vocational Training Institute Centre, Mota-Layja



VTI Centre

- Our centre is currently running GDA (General Duty Assistant) and BPO (Business Process Outsourcing) classes in which 22 Female trainees are training in GDA. and 30 in BPO including 15 boys and 15 girls. In third trade Electrical assistant, there are 12 boys trainees. students from around 12 villages are engaged with the VTI centre.



Science Fair

- Successfully organizing a science fair at the Mandvi taluka level to promote interest in science and foster creativity among student.



Livelihood Support Initiatives

- Empowering Communities Through Livestock Livelihood Support Initiatives



Animal Husbandry as the Primary Occupation

- Animal husbandry is the main occupation in the villages around Bada, for which a team of two veterinary doctors provides veterinary dispensary van treatment for animals at a token charge of ₹100 along with medicines.
- Treatments using a mobile dispensary van, benefiting 2500 herdsman and 9150 cattle.



Accessible Veterinary Care for Livestock (Veterinary Services)

- Providing mobile veterinary services ensures timely and affordable healthcare for animals, benefiting thousands of livestock owners and their animals.

Gaucher Land Development (Green Fodder)

- Arranging green fodder during summer and developing Gaucher land promote self-sufficiency, benefiting many herdsman and cattle, ensuring their well-being and productivity.



Livelihood Support Initiatives

- Empowering Communities Through Sustainable Livelihood Initiatives in Fishing and Agriculture



Support for Fishermen

- 283 fishermen in Bada, Nanalayaja, Babhdai benefiting from tools provision and fisheries awareness programs.
- Conducting fisheries awareness programs educates fishermen on best practices, conservation, and market trends, ensuring a thriving fishing industry.



Agricultural Assistance

- Distributed 30,000 bags of organic fertilizer to promote sustainable and eco-friendly agricultural methods, fostering a shift towards organic farming techniques.

Land Utilization

- Provided financial aid of up to ₹25,000 for two hectares to implement drip irrigation systems, benefiting 47 farmers across 80 hectares in six villages, enhancing water efficiency in agriculture.



Women Empowerment Initiatives

- Empowering Women Through Education and Livelihood Opportunities



Sewing Classes in Bada Village

- Providing sewing classes for 60 women in Bada village to enhance their skills and create economic opportunities within the community.

Self Help Groups in Greenfield Project Area

- Establishing 45 Self Help Groups in Greenfield project area to promote financial independence and sustainable livelihoods among women.



Community Development Initiatives

- Enhancing Community Facilities and Security Through CSR Initiatives



Renovation of Shed

- Upgrading the Community shed in Bada village to provide a better space for gatherings and events, fostering community unity and cultural preservation.
- Muslim community shed in Bada village
- Vachharadada temple shed in Bada village
- Koli Community shed Renovation In Bada village

Installation of CCTV Cameras

- Implementing CCTV cameras in Bada village to enhance security measures, ensuring the safety of residents and reducing crime rates in the area.

Solar Streetlight

- Solar street light facility in Total 5 village.



Environmental Initiatives



Tree Plantation Initiatives

- 2500 trees planted in Bhuj Smruti Van, 150 trees in Mandvi city, and 500 trees in Hanuman and Bhavnath Temples, promoting green cover and biodiversity.



Pond Deepening and Cleaning

- Pond deepening and cleaning activities conducted in Bada and Nanalayaja villages, enhancing water quality and supporting local ecosystems.



Sustainability Initiatives

- Exploring Key Areas for Sustainable Growth and Development

Water Harvesting and Environmental Initiatives

- Implementing water harvesting techniques to conserve resources and promote sustainable practices within the company premises.

Skilled Workforce Development

- Tailoring training programs to equip employees with the necessary skills and knowledge aligned with the evolving needs of the organization.

Livestock Area Strengthening

- Collaborating with NITARA Foundation to enhance livestock management practices, ensuring animal welfare and sustainable agricultural operations.

Organic Farming Market Development

- Promoting the growth of the organic farming market to meet consumer demand for healthy, sustainable produce and support local farmers.



CSR Activity Photo Gallery for Greenfield Project



Anganvadi worker Training



Animal Awareness Programme



Animal Vaccination camp



CSR Activity Photo Gallery for Greenfield Project



Assignment Distribution

• Respect

• Trust

• Ownership

• Integrated Team Work



CSR Activity Photo Gallery for Greenfield Project



Sheds for Schools & Temple



Exposure Visit



School Shade Inauguration

- Respect
- Trust
- Ownership
- Integrated Team Work



CSR Activity Photo Gallery for Greenfield Project



Biporjoy Cyclone Grocery Kit Distribution



Fishing Net Distribution



Balvatika Activity



CSR Activity Photo Gallery for Greenfield Project



Green Fodder Distribution



Gauchar Plot Development



Gauchar Plot Development

• Respect

• Trust

• Ownership

• Integrated Team Work



**Join us in creating a positive impact on the community and environment by supporting our CSR initiatives.
Let's work together for a sustainable future!**



Thank You



CSR Initiatives for “Greenfield Chemical Complex” Project



Outline of the CSR



1. Profile Of Villages
2. Health Initiatives
3. Education Initiatives
4. Livelihood Support Initiatives
5. Women Empowerment Initiatives
6. Community Development Initiatives
7. Environmental & Sustainability Initiatives

• Respect

• Trust

• Ownership

• Integrated Team Work

Expenditure year-wise for GHCL



ACTIVITY	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	Grand Total (in Lakhs)
Agriculture and Animal Husbandary Livelihood	85.24	94.35	174.31	319.45	313.99	288.81	348.98	221.26	396.64	429.34	2,672.37
Health	14.20	25.49	220.18	58.91	51.21	24.94	53.78	306.26	159.57	90.47	1,005.01
Education and Vocational Training Institute	28.51	31.14	36.15	67.58	40.25	25.53	36.12	253.21	390.60	608.43	1,517.52
Women Empowerment	1.43	2.28	3.02	7.44	4.28	3.45	6.72	9.72	29.58	44.25	112.17
Water Resource Development Program	9.98	8.01	48.45	22.30	12.38	17.11	27.49	29.31	24.33	30.45	229.82
Sanitation Program	51.65	83.71	94.23	51.73	33.27	-	-	-	-	-	314.59
Covid-19 Expenses	-	-	-	-	-	58.52	84.45	-	-	-	142.97
Aquaculture & Fisheries Development Exps	-	-	-	-	-	-	22.13	-	11.22	228.08	261.44
Rural Development, Hunger & Other	8.25	11.51	10.35	11.64	16.54	9.40	11.13	48.05	110.95	140.58	378.40
Establishment & Assets	39.98	47.07	77.01	80.71	74.30	65.06	70.31	51.80	45.99	48.11	600.34
Total CSR (RS. In Lakh)	239.24	303.56	663.70	619.76	546.22	492.82	661.11	919.61	1,168.89	1,619.71	7,234.62

- Respect

- Trust

- Ownership

- Integrated Team Work

Beneficiaries - Greenfield Project



Activities	2021-22	2022-23	2023-24	2024-25	TOTAL BENEFICIARIES
Agro-based livelihood	6040	152	1259	339	7790
Animal husbandry	2500	2792	9277	6434	21003
Health	5251	7769	8746	8262	30028
Education	215	2251	2117	2040	6623
Skill Development (NSDC)	0	0	0	285	285
Aquaculture & Fisheries Development	200	0	0	289	489
Women Empowerment	0	257	0	584	841
TOTAL BENEFICIARIES	14206	13221	21399	18233	67059

• Respect

• Trust

• Ownership

• Integrated Team Work

Expenditure year-wise for Greenfield Project



ACTIVITY	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	FY 2024-25	Grand Total (in lakhs)
Agriculture and Animal Husbandry Livelihood	0.00	0.00	119.07	50.90	114.66	126.24	410.86
Health	0.00	0.00	3.47	25.75	26.35	38.93	94.50
Education and Vocational Training Institute	0.00	1.00	8.21	15.84	59.41	64.58	149.04
Women Empowerment	0.00	0.00	0.00	0.38	0.00	2.11	2.49
Water Resource Development Program	0.00	0.00	0.00	0.00	4.50	11.17	15.67
Aquaculture & Fisheries Development Exps	0.00	0.00	22.13	0.00	5.76	13.95	41.84
Rural Development, Hunger & Other	3.33	0.00	0.00	0.99	47.51	32.39	84.22
Establishment & Assets	0.00	0.00	0.00	3.01	5.69	2.15	10.85
Total CSR (RS. In Lakh)	3.33	1.00	152.88	96.87	263.88	291.52	809.47

- Respect

- Trust

- Ownership

- Integrated Team Work

Beneficiaries - GHCL



Activities	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Agro based livelihood	6432	6040	5057	13726	11239	9548	13993	7931	12599	9677
Animal husbandry	1623	2584	2270	13919	10031	7859	11027	12162	18202	16962
Health	20322	21427	26018	32301	27833	21934	26718	27784	29418	26791
Education	4282	4250	3845	5416	3446	4762	2713	4662	5309	4908
Skill Development (NSDC)	0	0	0	0	0	0	0	680	1299	1750
Water Resource Development	151	50	62	106	55	1518	2083	2942	79	71
Sanitation	1221	2335	1746	855	676	0	0	0	0	0
Aquaculture & Fisheries Development	0	0	0	0	0	0	200	0	0	289
Women Empowerment	442	574	882	358	175	1162	2078	2662	2520	3410
Overall	34473	37260	39880	66681	53455	46783	58812	58823	69426	63858

- Respect

- Trust

- Ownership

- Integrated Team Work

Profile of Villages



Sr.No	Name of Village	House	Population
1	Bada	592	2719
2	Pachotiya	130	711
3	Janakpur	130	550
4	Bhisara	53	211
5	Bhada	187	802
6	Nana Layja	197	960
7	Mota Layja	599	2947
8	Bayath	326	1667
9	Padampur	186	923
10	Mapar	58	251
11	Badbhada	151	765
12	Modakuba	132	562
13	Vindh	76	308
14	Chagdai	15	74
15	Kokaliya	110	590
Total		2942	14040



- Respect

- Trust

- Ownership

- Integrated Team Work

Health Initiatives

- Enhancing Healthcare Access in Needed Communities



Mobile Health Unit (MHU) Outreach

- GHCL foundation's initiative includes a MHU that visits twice a week, providing vital healthcare services directly to remote villages.
- Health Services Provided by MSU are free of cost promoting health equity.
- 700-800 patients benefit every month.

Health Awareness Program

- Our aim is to create TB-free villages.
- Programs held in villages to raise awareness of health.
- Organize health camps and seminars to educate the community about various health issues, prevention methods, and healthy lifestyles.
- Overall well-being of the community and demonstrate its commitment to corporate social responsibility

• Respect

• Trust

• Ownership

• Integrated Team Work

Education Initiatives

- Empowering Communities Through Vocational Training Institute Centre, Mota-Layja



VTI Centre

- Our centre is currently running GDA (General Duty Assistant) and BPO (Business Process Outsourcing) classes in which 22 Female trainees are training in GDA. and 31 in BPO including 16 boys and 15 girls. In third trade Electrical assistant, there are 15 boys trainees. students from around 12 villages are engaged with the VTI centre.



Science Fair

- Successfully organizing a science fair at the Mandvi taluka level to promote interest in science and foster creativity among student.

• Respect

• Trust

• Ownership

• Integrated Team Work

13

Education Initiatives

- Empowering Communities Through Education Support Programs



Efforts to Reduce Dropout Rates

- Implementing initiatives to decrease dropout rates from Anganwadi to High School levels through targeted ideas like parent awareness programs.
- Implementing programs to ensure continuous education from Anganwadi to high school reduces student dropout rates.

Support and Training Across Levels

- Providing support and training to 389 Anganwadi children, 1197 primary school children, and 337 high school students, enhancing their learning outcomes.

• Respect

• Trust

• Ownership

• Integrated Team Work

Livelihood Support Initiatives

- Empowering Communities Through Livestock Livelihood Support Initiatives



Animal Husbandry as the Primary Occupation

- Animal husbandry is the main occupation in the villages around Bada, for which a team of two veterinary doctors provides veterinary dispensary van treatment for animals at a token charge of ₹100 along with medicines.
- Treatments using a mobile dispensary van, benefiting 2500 herdsmen and 9150 cattle.



Accessible Veterinary Care for Livestock (Veterinary Services)

- Providing mobile veterinary services ensures timely and affordable healthcare for animals, benefiting thousands of livestock owners and their animals.

Gaucher Land Development (Green Fodder)

- Arranging green fodder during summer and developing Gaucher land promote self-sufficiency, benefiting many herdsmen and cattle, ensuring their well-being and productivity.

• Respect

• Trust

• Ownership

• Integrated Team Work

11

Livelihood Support Initiatives

- Empowering Communities Through Sustainable Livelihood Initiatives in Fishing and Agriculture



Support for Fishermen

- 283 fishermen in Bada, Nanalayaja, Babhdai benefiting from tools provision and fisheries awareness programs.
- Conducting fisheries awareness programs educates fishermen on best practices, conservation, and market trends, ensuring a thriving fishing industry.



Agricultural Assistance

- Distributed 30,000 bags of organic fertilizer to promote sustainable and eco-friendly agricultural methods, fostering a shift towards organic farming techniques.

Land Utilization

- Provided financial aid of up to ₹25,000 for two hectares to implement drip irrigation systems, benefiting 47 farmers across 80 hectares in six villages, enhancing water efficiency in agriculture.

• Respect

• Trust

• Ownership

• Integrated Team Work

12

Community Development Initiatives

- Enhancing Community Facilities and Security Through CSR Initiatives



Renovation of Shed

- Upgrading the Community shed in Bada village to provide a better space for gatherings and events, fostering community unity and cultural preservation.
- Muslim community shed in Bada village
- Vachharadada temple shed in Bada village
- Koli Community shed Renovation In Bada village

Installation of CCTV Cameras

- Implementing CCTV cameras in Bada village to enhance security measures, ensuring the safety of residents and reducing crime rates in the area.

Solar Streetlight

- Solar street light facility in Total 5 village.

Environmental Initiatives



Tree Plantation Initiatives

- 2500 trees planted in Bhuj Smruti Van, 150 trees in Mandvi city, and 500 trees in Hanuman and Bhavnath Temples, promoting green cover and biodiversity.



Pond Deepening and Cleaning

- Pond deepening and cleaning activities conducted in Bada and Nanalayaja villages, enhancing water quality and supporting local ecosystems.

Sustainability Initiatives

- Exploring Key Areas for Sustainable Growth and Development



Water Harvesting and Environmental Initiatives

- Implementing water harvesting techniques to conserve resources and promote sustainable practices within the company premises.

Skilled Workforce Development

- Tailoring training programs to equip employees with the necessary skills and knowledge aligned with the evolving needs of the organization.

Livestock Area Strengthening

- Collaborating with NITARA Foundation to enhance livestock management practices, ensuring animal welfare and sustainable agricultural operations.

Organic Farming Market Development

- Promoting the growth of the organic farming market to meet consumer demand for healthy, sustainable produce and support local farmers.

• Respect

• Trust

• Ownership

• Integrated Team Work



GHCL FOUNDATION TRUST

THE CSR Wing of GHCL Ltd.



GHCL: CSR outreach



Gir- Somnath district
103 villages



Kutch (Greenfield) district
16 villages

• Respect

• Trust

• Ownership

• Integrated Team Work



GHCL: Overview of CSR Policy

The GHCL Foundation ensures that its social responsibility initiatives align with its CSR vision and GHCL's core values. It prioritizes initiatives that are replicable, scalable, and sustainable, thereby reinforcing GHCL's standing as a responsible corporate citizen.

- **Outreach:** Ensuring accessibility to the last mile
- **Scalability:** Generating multiplier effects
- **Sustainability:** Aligning activities with sustainable development goals





GHCL: Stakeholders Engagement

Village-Level Engagement:

At the village level, consultations serve as platforms for discussions and problem understanding. Engaging stakeholders such as farmers, women, youth, parents, School Management Committees (SMCs), and extension volunteers significantly enhances community outreach. Activities like farm visits and structured exercises such as Participatory Rapid/Rural Appraisal (PRA) and Farmers Group Discussions (FGDs) are conducted to identify farming-related issues.

Panchayat-Level Engagement:

Interventions involve maintaining communication with the village leadership of the Gram Panchayat for project planning and implementation. To ensure community participation, need-based Community-Based Organizations (CBOs) are formed, including Women Self-Help Groups (SHGs), user groups, Water Management Committees (Pani Samiti), farmer groups, and parent groups.

Expert Engagement for Needs Assessment:

GHCL engages the services of Ernst & Young (E&Y) and PWC for the identification and impact assessment of CSR projects.



Community Development Initiatives..

The community development initiatives taken up by the GHCL Foundation.

1. Agriculture and Animal Husbandry:

- **Farm based livelihood:** Drip and sprinkler irrigation, horticulture, organic manure, Agri Inputs, farmer training and exposure.
- **Animal Husbandry:** Artificial insemination, animal treatment camp, fodder management, cattle nutrition support, breed improvement programme, entrepreneur development, engagement of women farmers for collective action etc.

2. Health & Hygiene: Mobile Medicare, Eye camps, Early detection of **Cancer**

- **COVID Breakout Initiative:** Proactive action

3. Skill development and Education: Vocational training Institution, Site schools, LEP class, preprimary education support at Anganwadis, primary school support,

4. Women Empowerment : Formation of SHGs, Gender equity and Entrepreneurships

5. Rural Development initiatives: Majorly infrastructure development

6. Water: Drinking water scheme, RRWHS, User training and enhance water handling practices among community



GHCL: Sutrapada CSR Spent in last Ten years



• Respect

• Trust

• Ownership

• Integrated Team Work



GHCL: Greenfield CSR Spent in last Five years



• Respect

• Trust

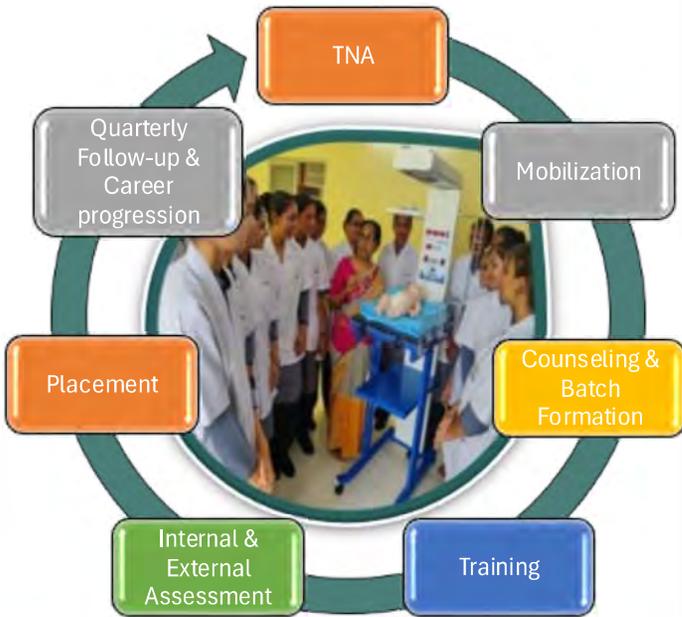
• Ownership

• Integrated Team Work



Vocational Skill Training Institutes (VTI)

Approach Methodology VTI



• Respect

• Trust

• Ownership

• Integrated Team Work



Community Outreach & Services Provided (Till March 2025)

Agricultures



53K farmers benefited

livestock



33K Household

Organic Manure



3.08 lac bags, 15.4K hac

Horticulture



3.17 lac saplings

Skill Development



4245 Trainees

Education



32K Students

Women Empowerment



3541 Members

Fisherman Livelihood



742 Household

• Respect

• Trust

• Ownership

• Integrated Team Work



Community Outreach & Services Provided (Till March 2025)

Health care



4.0 lac plus patients

Eye Camps



3470 Cataract Surgery

COVID Breakout



Spent 1.43 Cr.

Roof Rain Harvesting



1445 Units

Drinking Water



9072 Household

Zero Hunger



91 Monthly Grocery Kits
to Helpless old age people

• Respect

• Trust

• Ownership

• Integrated Team Work



Beneficiary Reach Across Key Activities

Sutrapada

Activities	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Agro based livelihood	6432	6040	5057	13726	11239	9548	7953	7779	11340	9338
Animal husbandry	1623	2584	2270	13919	10031	7859	8527	9370	8925	10528
Health	20322	21427	26018	32301	27833	21934	21467	20015	20672	18529
Education	4282	4250	3845	5416	3446	4762	2498	2411	3192	2868
Skill Development (NSDC)	0	0	0	0	0	0	0	680	1299	1465
Water Resource Development	151	50	62	106	55	1518	2083	2942	79	71
Sanitation	1221	2335	1746	855	676	0	0	0	0	0
Women Empowerment	442	574	882	358	175	1162	2078	2405	2520	2826
Overall	34473	37260	39880	66681	53455	46783	44606	45602	48027	45625



Beneficiary Reach Across Key Activities

Greenfield

Activities	2021-22	2022-23	2023-24	2024-25
Agro based livelihood	6040	152	1259	339
Animal husbandry	2500	2792	9277	6434
Health	5251	7769	8746	8262
Education	215	2251	2117	2040
Skill Development (NSDC)	0	0	0	285
Fisherman Project	200	0	0	289
Women Empowerment	0	257	0	584
Overall	14206	13221	21399	18233



GHCL CSR : Impact on the community

Before GHCL Foundation Trust (GHCLFT):

Funding was often directed by political and local leadership, framed as philanthropy or charity. This made it difficult to meet everyone's expectations and created challenges in ensuring fairness and sustainability.

After GHCL Foundation Trust (GHCLFT):

A transformative shift was made toward need-based, pro-poor, and sustainable initiatives. Emphasis was placed on a participatory approach, empowering local communities and reducing dominance by influential individuals.



Key CSR Achievements over the years



2015-16

Alidhra & Bhuvavada Pani samiti awarded Collaborated with TWM for CADP III Project Collaborated with TATA- CSPC

2016-17

Winner for 'Sustainable and impactful CSR' award – 2017 in 'Large category ' by Gujarat CSR Authority.



2017-18

Honoured Golden peacock Award on best CSR – 2017





Key CSR Achievements over the years



2018-19

GHCL Foundation Trust received 'Saurashtra Eminence Award - 2019' for the great work done towards 'Rural Development and CSR' from Divya Bhaskar Group.

2019-20

The Federation of Indian Mineral Industries (FIMI) awarded GHCL for innovation in the field of water management and soil fertility.



2021-22

GHCL Foundation Trust received the prestigious Mahatma Awards 2021 under CSR Excellence and Sustainability categories.





Key CSR Achievements over the years

2023-24



2021-22

The Ramdevpir Mahila Vikash – Sutrapada has won the “Pidilite Mahila Udhyaami Awards - 2023”

2022-23

We secure the third rank in the best industry for the CSR category of the National Water Award – 2022. This award is announced by the Ministry of Jal Shakti.



GHCL Foundation has been honoured with the prestigious Award for Excellence in Disaster Management by Parul University. This recognition is a testament to our unwavering commitment to safeguarding communities.





Thank You





ENVIRO LEGAL DEFENCE FIRM <eldflegal@gmail.com>

Service in Vijaykumar Karsanbhai Gadhavi Vs. Union of India & Ors. [Appeal No. 19 of 2025]

1 message

ELDF <eldflegal@gmail.com>

Wed, Jun 25, 2025 at 10:06 PM

To: litigation.life@gmail.com, RAHUL CHOUDHARY <litigation@dclawchambers.com>, MOEF <secy-moef@nic.in>, STATE OF GUJARAT <chiefsecretary@gujarat.gov.in>, GUJARAT POLLUTION CONTROL BOARD <ms-gpcb@gujarat.gov.in>
Cc: Mansi Bachani <mansi@eldfindia.com>, Gitanjali Sanyal <gitanjali@eldfindia.com>

Dear Sir/Ma'am

Please find attached the copy of Sur- Rejoinder filed on behalf of Respondent No. 4 GHCL in the abovementioned case.



Sur Rejoinder.pdf

Thanks & Regards

--

Sameer Manher

Clerk

Enviro Legal Defence Firm

29, Presidential Estate LGF,

Nizamuddin East New Delhi – 110013

Ph. No. 011-40573181