EXECUTIVE SUMMARY

of

MARINE EIA REPORT

for

Expansion of Existing Jetty by Setting up a New Berth at Gulf of Kutch, Jamnagar, Gujarat

Project Proponent

Reliance Industries Limited

Prepared by

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EXECUTIVE SUMMARY

1. Introduction

Reliance Industries Limited (RIL), owns and operates an integrated petroleum refinery cum petrochemical complex along with associated infrastructure facilities at Jamnagar. RIL has established and operates a state-of-art Captive Marine Terminal situated in the Gulf of Kachchh, Gujarat, consisting of five SPM's (three SPMs for crude oil import and two SPMs for product export), a liquid jetty consisting of five berths (namely A, B, C, D and A1 for exporting products) and a Ro-Ro / Lo-Lo jetty facility for handling over dimensional cargo for projects. To augment additional product evacuation through marine route, it is proposed to expand the existing liquid jetty by setting up a new berth to the south east of the existing liquid jetty. The Expert Appraisal Committee (Infrastructure and CRZ Committee) has issued Terms of Reference permitting use of the baseline data collected in 2012-13 for the marine environment to prepare the EIA and predict the impacts. The following report is based on the baseline data that CSIR-NIO had collected during May 2012 (1st phase), August 2012 (2nd phase) and February 2013 (3rd phase).

2. Project Description

RIL proposes to construct a new berth that can handle up to 8 MMTPA of petroleum and petrochemical products. It is proposed to expand the existing jetty by installing an approach trestle from the knuckle point and berth operating platform along with mooring and breasting dolphins on piles, towards the south- east side of the existing jetty at 2487492.941 N, 587053.601 E (WGS 84 datum). The New Berth will be designed to handle ships of LOA ranging from 105 to 230 m with a maximum draft of 13.0 m. The average depth in front of new berth is presently about -13.5 m CD. To optimise the movement of ships in the existing approach channel and improve turnaround time of the ships, it is proposed to use the area to the North East of the new berth as a turning circle. The New Berth will handle 8 MMTPA of liquid products like Glycols, Acetic Acid, Naphtha, Paraxylene, Diesel, Benzene, Vinyl Acetate Monomer and Phenol. The jetty structures such as berth operating platform, mooring and breasting dolphins and approach trestle will be supported on piles. The total pile foot print area will be 124.28 m².

3. Prevailing marine environment off Sikka

The monitoring domain of the present study involved the section of the Gulf between the Siri and the Munde Reefs upto the water depth of about 35 m. The water quality was assessed at 17 stations. Currents in the Sikka creek are largely tide induced and vary considerably with the tidal phase. The currents measured at station 9 during the study indicated that the maximum currents in the location were 0.6 m/s and the direction veered between 100 to 300 degrees which indicated that the currents were parallel to the channel. The tide data collected at Sikka during 2012 and 2013 indicated that the spring tide amplitude ranged from 5.8 to 6.2 m depending on the season.

The maximum water temperature recorded during the present monitoring (May 2012) was 32.2°C at station 7 which was located between the Goos reef and GSFC jetty. The average pH off Sikka varied between 7.9 – 8.6. Average SS in the coastal waters of Sikka varied from 25-64 mg/l,
30-54 mg/l and 20-30 mg/l during May 2012, August 2012 and February 2013 respectively. The salinity off Sikka varied in the 37.2–39.5 ppt range during the study period and the salinity structure of the Gulf off Sikka was generally comparable between the pre- and post-refinery periods.

The DO values on most occasions were above 4.0 ml/l in May, August 2012 and February 2013. Results indicated an overall subtle decrease in the concentration of PO$_4^{3-}$-P and NO$_3^{-}$-N with respect to the baseline. The decrease of both the major nutrients suggests the possibility of increase in productivity at the primary level off Sikka. However, there appeared to be a minor but systematic increase in the concentration of NH$_4^{+}$-N in the post-refinery phase which could be due to enhanced traffic of ships/boats. The overall levels of PHc in water off Sikka were low indicating that the prevailing traffic of crude oil and its products in and around the Sikka creek had not resulted in enhancement of PHc in water. Average concentrations of phenols in water were low during the monitoring period.

The bed sediment off Sikka was heterogeneous with the texture varying over short distances. Silt dominated wherever the sand percentage was low. Overall results did not indicate increase in concentrations of metals off Sikka during the post-operational phase of the refinery. The levels of PHc in the subtidal sediment during the pre- and the post-operational phases of the refinery were comparable and there was no evidence for increase in the sediment burden of PHc due to unloading of crude oil at the SPMs and loading of petroleum products at the berths of the Marine Terminal. C$_{org}$ concentrations recorded in the post-operational phase of the refinery were however low and compared well with near pristine areas of the Gulf though the nearshore segment sustains extensive mangroves that are known to contribute organic matter. It therefore appears that the organic matter, both natural and anthropogenic, entering the system is effectively consumed and mineralised.

The relative concentrations of chlorophyll a were higher during premonsoon (av 1.8 mg/m$^3$) as compared to monsoon (1.0 mg/m$^3$) and post monsoon (1.7 mg/m$^3$) as expected. The phytoplankton counts were higher during May 2012 and February 2013 as compared to August 2012. The populations were dominated by Nitzschia during May 2012 (29%) and August 2012 (30%). During February 2013, the most dominant phytoplankton genera was Thalassiosira (16.9%). In general, the coastal waters off Sikka reveal good production potential for zooplankton associated with significant spatial and seasonal changes. Overall, about 13, 4 and 23 groups of intertidal macrobenthos were recorded off Sikka during May 2012, August 2012 and February 2013 respectively. The subtidal macrobenthic abundance indicated a decrease in all segments of the study area as compared to the baseline data. The important fish landing centres in the vicinity of RIL area which falls under Jamnagar zone are Sachana, Baid, Sarmat, Bedi and Sikka which together contributed about 5848 t, 3791 t and 3703 t of fish landings in 2008-09, 2009-10 and 2010-11 respectively to the total landings of the Jamnagar District. The experimental trawling off Sikka-Vadinar revealed almost comparable catch rate and species composition of trawl fish during the monitoring period (April 2012) with that of earlier data. Fishing activities are not permitted in the port notified areas.

The study area of Goos reef is located on the eastern side of Sikka creek. The hard corals consisted of Favia favus, Goniastrea pectinata, Platygrya sinensis, P. compressa, P. sp, P. lutea and Montipora explanata. The sites revealed many corals in live and healthy conditions during the survey period. At Narara east, the commonly found corals were F. favus, F. speciosa, P. sinensis, P. pini, S. savignyana, C. serailia, G. pectinata, T. peltata, F. complanata and P. lutea. At
Sikka, *Favia favus, Favites complanata, Siderastrea savignyana, Porites compressa, Platygyra daedalea. Dendronephthya brevirama* were observed. Corals identified from Munde reef were *Goniopora nigra, G. minor, G. planulata, Acanthastrea hille* (*Acanthastrea simplex*), *Montipora explanata, Favia favus, Siderastrea savignyana, Platygyra sinensis* and *Cyphastrea serailia*.

Stretches of dense mangroves occur at the upper intertidal zone along the Sikka coast roughly estimated to cover 7.5 km² area including 0.5 km² plantation of *Avicennia* by the department of forests the survival rate of planted mangroves is over 80%. The major species encountered in this region is *Avicennia marina*. Other species of mangroves such as *Rhizophora mucronata* (height <1 m) and *Ceriops tagal* are rare among the *Avicennia* stand. The mangroves flora in general, in the region are represented by 7 species dominated by natural *Avicennia marina, Rhizophora mucronata* and *Avicennia officinalis*.

4. **Modeling studies**

From the modelling studies results, it can be observed that there is no significant change in the rates of accretion and erosion at the jetty location due to the development activities. Changes in bed levels at the proposed jetty were found to minor. Oil spills and spillages of immiscible petrochemicals at the new berth and approach channel would move towards Kandla, Mundra, Munde reef, Sikka or Vadinar coasts depending on the spill residence time, different tidal cycles and seasons. Unlike the oil spills and immiscible petrochemicals (lighter than sea water) spills in the marine environment, the miscible spills are not affected by the wind in their trajectories but the spread depends on the mixing characteristics of the water mass. The rate of dispersion would depend on tidal conditions. In case of an instantaneous spill of 700t of miscible petrochemicals at the new berth and channel, ambient conditions will be reached in 24 hours.

Considering the small channel leading to the new liquid jetty the collision frequency for the existing traffic of 912 vessels in the RJMT area works out to be 0.0437 or 1 in 23 years. With the projection of additional 204 vessels calling on the new jetty the frequency increases to 0.05357 or 1 in 18 years. The grounding frequency involving a tanker carrying crude oil or petroleum products will be 1 in 8 y.

5. **Potential marine environmental impacts**

From modeling results, it can be concluded that the variations in current speeds and therefore erosion/deposition trends in the vicinity of the jetty are not expected due to jetty construction. The turning circles and the navigational channel are not impacted, as no change in the depth contours are envisaged. Apart from local transient pulses of SS and deterioration due to accidental spillages, the water quality of the region will not be influenced adversely during the construction phase. Generally the enhancement of SS during the piling activities is expected to result in a decrease in phytoplankton standing stock. This impact will be localized and temporary. Also the type of methodology of piling to be adopted, will eliminate increase in SS. If the piling activity is prolonged, herbivorous zooplanktons may deplete locally due to reduced phytoplankton crop. The proposed construction activities is expected to destroy 1.3 kg biomass and 395.7 x 10³ population of macrobenthos. The fauna that would be majorly affected due to the proposed piling area are polychaetes, amphipods and anthozoans. The overall damage to benthic habitats and
fauna in the region would be localized, temporary and reversible in the subtidal areas (except at the foot-prints of piles). The recovery could start once the piling activities are completed.

The proposed construction area is completely in subtidal area and is about 4 km from mangrove vegetation. Thus, any direct impact due to construction activities is not expected. The Goos, Sikka and Munde reefs, which exhibit ecologically sensitive habitats of corals, are at a distance of 1.5-3 km to the proposed berths. The impact on these corals could be avoided during piling by exercising due care. Major fishing activities like trawling are banned in the port notified areas. Hence, there will not be impact on the major fishing activities. Fishes respond to sounds similar to vibro-hammers by consistently displaying an avoidance response and not getting habituated, which could prevent fish from reaching breeding or spawning sites. However, the piling methodology to be adopted by RIL is expected to minimise the impact of noise and vibration considerably. Also piling is a short term one time activity, hence impacts if any, are minor and reversible in nature.

RIL would be handling various petroleum and petrochemical products i.e. diesel, naptha, paraxylene, benzene, glycols, acetic acid, phenol, vinyl acetate monomer. In case of uncontained spillages, the spilled products may affect the mangroves at Munde, Goos, Sikka and Narara-Vadinar. The impact on intertidal corals of surrounding area of project site, will be based on the movement of the spill or if the spill is not contained before reaching the intertidal corals. A fraction of petrochemicals products may sink at the bottom of coastal water affecting the plankton and benthic organisms. However, the recovery of plankton will be quick through repopulation of the community not affected by oil. Eggs and larvae of fishes, crustaceans and molluscs in the uncontained spill area which are sensitive to PHc will be affected. However, it is unlikely that any localised losses of fish eggs and larvae caused by a spill in the Gulf would have discernible effect on the size or health of future adult populations.

Oil spillage is a contingency. The floating oil above corals may not cause severe damage, but if it settles on them during exposed condition they may be severely affected. Several sub-lethal effects such as interference with reproduction, abnormal behaviour and reduced or suspended growth may also occur. The recovery of such coral reefs would be slow. A large oil spill can temporarily reduce the fish catch from the area as fish might migrate from the affected zone. Limited mortality may also occur particularly when the oil concentrations in water go abnormally high.

6. **Oil Spill Response Plan**

RIL has a robust Oil Spill Response Plan, which has a well-designed strategy to identify emergency organisation structure, responsibilities, communications and procedures to respond to oil spill emergencies in the marine area. It also delineates the equipment and facilities that are to be maintained in readiness at all times to handle any emergency and mitigate its adverse impacts. The Disaster Management Plan has been prepared to take care of any oil leakage in the Gulf. The response facilities / equipment has been established for Tier 1 capability and is based on a spillage of 700 tons. The Oil Spill Response Plan has been approved by Indian Coast Guard. For spillages more than Tier I level, RIL has developed a mutual aid scheme has with M/s Essar Oil Ltd, Vadinar and M/s Bharat Oman Refinery Ltd, Vadinar.
7. **Mitigation measures and Marine Environment Management**

The field data collected during the study indicated that the water quality of the study area, in general was good, well oxygenated and in well-mixed condition. To mitigate the impacts of the proposed development, the following mitigation measures are suggested.
- Adopt the piling technology with least impact on the marine environment
- Optimize and adhere to the construction schedule and not prolong the same.
- Construction activities not to be carried out beyond the specified geographical project area which should be kept to a minimum.
- Avoid spillages of construction materials while transferring them into the construction barges.
- Avoid crowding of navigational channel so that to prevent the accidents and subsequent spillages.
- Operational noise levels of construction equipment’s and activities to be kept to a minimum.
- Preparedness to meet emergencies such as fire due to leakages of highly inflammable chemicals.
- Regular monitoring of the marine environment
- The new berth will be designed for ‘zero leak’ of product, in line with the existing RIL jetty design.
- The loading arms will be provided with Powered Emergency Release Coupler (PERC) to avoid possibility of leak. The loading arms are also equipped with Emergency Shut Down Systems (ESDS) to stop all the cargo operations, in case of any emergency or rough weather.
- Comprehensive Oil Spill Management Plan: Reliance already has a well-established ‘Oil Spill Management Plan’ which provides a visible form of information, thus reducing the chance of oversight or error during the early stages of dealing with an emergency situation. For this plan to be more effective, it must be extended to the personnel working/handling the operations for the new berth. The following items must be included in the plan to be effective:
  - Familiar to those marine terminal staff with key response functions;
  - Regularly exercised; and,
  - Reviewed and updated on a regular basis

8. **Conclusion**

The EIA study report includes the prevailing marine ecological status of the coastal water of Sikka, impact assessment due to the proposed project, appropriate mitigation measures and environmental management plan including oil spill contingency plan. It can be concluded that the construction and operation of the berth, as proposed, is not likely to have significant adverse impacts on the marine ecology, if proper mitigation measures are adopted.