7. POTENTIAL MARINE ENVIRONMENTAL IMPACTS

SAUKEM now proposes to augment the capacity of the existing intake facilities by replacing the existing corroded pipelines as well by creating 2 new stilling basins and to increase the seawater intake to 400 MLD from the existing 176 MLD. Major potential negative marine environmental impacts due to the proposed activities would be largely associated with (a) trenching, laying of the pipeline and backfilling, and (b) increased water intake. Evidently, potential negative impacts on marine ecology can arise during the construction as well as the operational phases of the water intake.

7.1 Construction phase

Creation of stilling basins, connecting channels, replacing existing pipelines in a near shore environment may render certain impacts during the construction. Adverse impacts on the marine ecology during the construction phase can be essentially due to (i) change in the hydrodynamic characteristics of the area, (ii) enhancement of SS due to excavation/maintenance of the channel (iii)activities of work force and equipments engaged in the construction area.

7.1.1 Hydrodynamic characteristics

Constructions of new stilling basins, connecting channels and replacing existing pipelines etc. have potential to modify the hydrodynamic characteristics. Since the activity will be in a confined area the changes in the flow regime likely will be local and of small magnitude.

7.1.2 Water quality

Trenching in the intertidal and subtidal areas for relaying the pipeline has a high potential to disperse the bed sediment into the water column thereby increasing the SS in water. The nearshore subtidal and intertidal areas off the present water intake location are composed of a rocky substratum. Hence, increase in SS in the coastal waters of Porbandar due to the pipe relaying activities is not expected.

In areas where the sediment is polluted there is a fear of release of pollutants entrapped in sediment to the water column when the bed is disturbed thereby mixing interstitial water rich in contaminants with the overlying water. However, as the substratum of the intake region is rocky, there would not be deterioration in water quality on this account.

7.1.3 Sediment quality

The sediment that is leftover after the trench is backfilled subsequent to the laying of the pipeline, would be re-distributed by tidal circulation which may change the texture of the sediment of nearby areas, particularly of the intertidal region. The impact however would be minor. Misuses of the intertidal area by the workforce employed during the construction phase, can locally degrade the sediment quality by increasing BOD and populations of pathogens. The impact, however, would be minor and temporary and recovery would occur when the source of this contamination is eliminated at the end of the construction phase.

7.1.4 Flora and fauna

Hectic construction activities in the intertidal and subtidal areas would influence the local biotic communities, particularly the macrobenthos along the corridor selected for laying the pipelines, diffuser and intake well. It is envisaged to remove the existing pipelines and replace the same along the same route. Also the intertidal as well as the subtidal zones are rocky. Hence, no significant loss of fauna is expected. Also, no increase in turbidity due to enhanced levels of SS is expected. However, if at all any minor releases of superficially settled sediments happen, it would be local and temporary.

7.1.5 Noise

The most widespread source of noise from typical construction equipments is generally due to internal combustion engines – usually diesel, which provide operating power. Engine sound typically predominates, with exhaust noise normally being the major source, and inlet sound level and structural sound level being of secondary importance. Construction related noises are usually of a temporary duration and can be, relatively intermittent. However, exposure to noise can harm workers' health. The most well-known effect of noise at work is loss of hearing, however, it can also exacerbate stress and increase the risk of accidents.

7.1.6 Miscellaneous

Large number of machinery, construction materials and work force would be brought to the site. Hence, aesthetics of the area may deteriorate. Moreover, left-over solid waste and that generated during construction period would be a source of nuisance if not cleared from the site. The extent of impact on marine ecology would also depend on duration of the construction. If

the construction is prolonged due to time-overruns or improper planning, the adverse influence would increase accordingly.

7.2 Operational phase

Marine environmental implications during the operational phase of the project would be essentially confined to the adverse influence of additional intake of seawater on the hydrodynamics, flora and fauna of the region.

7.2.1 Intake of seawater

The potential adverse marine environmental impacts associated with withdrawal of seawater from intake point is essentially limited to the construction phase. SAUKEM has proposed the enhancement of seawater intake from 176 MLD to 400 MLD through the existing intake facilities by replacing the existing corroded pipelines. Modeling studies based on present field observations indicate that that the currents would increase by maximum of 0.04 m/s at the intake location in case the proposed additional seawater is drawn. Also the impact of the seawater intake would be limited to around 20 m radius from the intake location.

The other impacts during operational phase are minor and localized and may manifest in the form of damage to biota in seawater that is pumped. Thus, for instance, phytoplankton, zooplankton and fish eggs and larvae which are sucked in, get destroyed. A few larger organisms may get sucked and killed at the filter screens. The loss of biomass of phytoplankton, zooplankton and other organisms may be negligible to cause any major impact on the ecology of coastal waters of Porbandar. However, the project proponent will have to install screens before the pump house will prevent the larger organisms from being harmed or destroyed. Even if the entrained organisms are not killed, young fishes that undergo physical damage may become prey to predators.

8 MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT PLAN

It is important that certain environment protection measures are conceptualized and strictly implemented at the planning and design stages of the project itself so that the negative impacts during construction and operational phases are reduced to a minimum in order to protect the rich biodiversity of the Gulf and avoid anthropogenic shocks.

8.1 Intake water channel

Impingement and entrainment of marine organisms, due to large quantity of intake, should be avoided by placing suitable moving screen at the intake. However, destruction of very small organisms cannot be avoided.

8.2 Miscellaneous

The following actions are suggested to minimize impact on marine ecology during the construction phase:

(**i**) The area of construction should be confined to the minimum required and spillages of activities outside the project site should be avoided.

(**ii**) Major pre-fabrication jobs should be undertaken in a yard on land located sufficiently away from the HTL.

(**iii**) Good sanitation and water supply facilities should be made available to the work force.

(**iv**) Labor colonies should be set-up away from sea.

(**v**) The operational noise level should be kept to a minimum particularly in the nearshore region through proper lubrication, muffling and modernization of equipment.

(**vi**) Regular preventive maintenance of equipment used for construction should be practiced.

(**vii**) General clean-up along the corridor, adjacent areas and subtidal regions should be taken-up and extraneous materials such as equipments, pipes, drums, sacks, metal scrap, ropes, excess sediment, make shift huts and cabins should be cleared from the site.

8.3 Monitoring environmental quality

The guiding principal of environment management is to ensure that the impacts of activities on the environment are within its assimilative capacity. A plan of actions for mitigating predicted adverse effects under normal expected conditions must be integrated into the project

itself. This is best done by verifying the expectations of environmental changes from the pre-project baseline. Baseline settings of different relevant environmental components related to study area, potential impacts on these components and the mitigation measures for the identified adverse impacts are already discussed. The preparation of the Environmental Management Plan (EMP) is discussed in this chapter.

8.3.1 Monitoring of marine environment

The coastal waters of Porbandar represent near baseline conditions of the marine environment. The release of soda ash effluent as well as intake of seawater could result in certain long term changes in the marine coastal system. Proper strategy is therefore required to ensure the health of the marine zone. This would require establishment of baseline quality, periodic monitoring of coastal waters and evaluation of results to execute timely measures in the event of adverse influences.

8.3.2 Baseline quality

The coastal waters are subject to temporal as well as spatial variation, which can be considerable in a coastal environment. The results of present studies can be considered as a baseline for future monitoring.

8.3.3 Post-project monitoring

In order to ensure that there is no deterioration in marine environmental quality during operational phase of the project and necessary remedial measures are taken whenever warranted, it is necessary to undertake marine environmental monitoring. Sampling stations should be similar to those sampled in the baseline study. It is also important to sample in similar season as that of the previous study to make reliable comparison. Routine monitoring should be undertaken at least once in a year preferably during the critical season i.e. premonsoon (April-May).

The parameters to be monitored are listed below:

Water quality: Water samples should be studied for temperature, pH, salinity, DO, BOD, (or total organic carbon), nitrate, nitrite, ammonia, dissolved phosphate, PHc and phenols.

Sediment quality: Sediment from subtidal and intertidal regions should be analysed for texture, organic carbon, phosphorous, aluminium, chromium, nickel, copper, zinc, cadmium, lead, mercury and PHc.

Flora and fauna: Biological characteristics should be assessed based on primary productivity, phytopigments, phytoplankton populations and their generic diversity; biomass, population and diversity of zooplankton; biomass, population and diversity of benthos.

Assessment

The results of each monitoring should be carefully evaluated to identify changes if any, beyond the natural variability identified through baseline studies. Gross deviation from the baseline may require a thorough review of operations at the berths to identify the causative factors leading to these deviations and accordingly, corrective measures to reverse the trend will be necessary. The depth at the soda ash effluent release location is subjected to erosion. However, the effluent being high density in nature would be responsible for the deposition. Therefore it is suggested that the depth in the area of 100 x 100 m should be monitored at least once in a year near the disposal site.