

EXECUTIVE SUMMARY

1.0 THE PROJECT

1.1 Background

Chemplast Sanmar Limited (Chemplast) is planning to construct a PVC plant and a Marine Terminal Facility (MTF) in Cuddalore District of Tamil Nadu. The marine terminal facility is required to import the raw material (VCM) for the PVC plant.

The capacity of the proposed PVC plant is 1,70,000 TPA. PVC will be manufactured from the Vinyl Chloride Monomer (VCM) which is imported and handled at the proposed marine terminal. The PVC plant is scheduled to be commissioned in January-March 2004. The proposed marine facility is planned for completion in August-September 2003, which is ahead of commissioning of PVC plant.

1.2 Location of the Project

The site of the proposed PVC plant is located in a notified industrial area (phase II) declared as chemically hazardous zone, developed by State Industries Promotion Corporation of Tamil Nadu (SIPCOT) along the National Highway No NH45A Cuddalore – Chidambaram stretch near Sembanakupam village. SIPCOT is a body under Government of Tamil Nadu.

The PVC plant site is bounded by Uppanar canal on the east and NH45A on the west. The total area earmarked for the PVC plant is around 100 acres.

The marine terminal is located north of Chitterapettai Village, 3.5 km east of the PVC plant site, 8kms south of the Cuddalore Minor Port and falls within the extended port limits.

The coastal stretch in which the development of the Marine Terminal has been proposed is under CRZ III of the Cuddalore District Coastal Zone Management Plan (CZMP). This confirms that this specific stretch does not have ecologically sensitive areas like national parks/marine parks, sanctuaries, reserve forests, wildlife habitats coral/coral reefs, areas close to breeding and spawning grounds of fish and marine life, natural beauty and heritage places, areas rich in genetic diversity.

1.3 Project Components

1.3.1 PVC Plant

1.3.1.1 Analysis of Alternative PVC technologies

In order to select a cleaner technology, four technologies were evaluated. The parameters used for evaluating the technologies included clean technology, low utility consumption, conservation efficiency, emission per ton of product, air pollution and liquid control facilities, solid wastes, noise levels and VCM handling & storage. Maximizing conversion of VCM to PVC was a key factor. The outputs of the evaluation confirmed INOVYL technology of Belgium as the preferable technology due to its high VCM to PVC conversion ratio: 1003 kg of VCM per 1000 kg of PVC resin as final product.

1.3.1.2 Components of PVC Plant

The PVC plant will comprise ;

- PVC plant facilities
- Tank farm to store VCM and Fuel
- Utilities and services – Fire water storage tank, steam, condensate & boiler feed water tank, water receiving, distribution & treatment, instrument and plant air, fuel system, chemical storage & handling, cooling water system and captive power plant
- Environmental and pollution control systems- effluent and sewage collection systems, effluent treatment plant, air pollution control equipment and VCM recovery system
- Effluent disposal pipeline (onshore and offshore) and diffuser system
- Green belt spreading over an initial area of 28,602m²
- Secured landfill

PVC will be manufactured by suspension polymerization of VCM, in large batch autoclave reactors. The power requirements will be met by a captive power plant and the water requirements from ground water sources will be supplied by SIPCOT. De-mineralized water will be used for the boiler feed and process water. One cooling tower of 3900 m³ /hr capacity along with three circulation pumps are proposed. The nitrogen required for blanketing and continuous purging will be generated with in-house facilities.

1.3.2 Marine Terminal Facilities

1.3.2.1 Analysis of alternative marine terminals

An analysis of alternatives, listing out the broad environmental and social impacts for various marine terminal configurations has been carried out, to select the optimal marine terminal scheme.

The important environmental attributes considered in the impact analysis are alteration in littoral drifts pattern, increase in turbidity, destruction to benthic communities, dredging volumes, air and noise pollution, relocation of fishing villages, ship wastes, maintenance dredging etc.

Based on the output of the impact analysis on alternative marine terminal configurations along with the features listed below, the marine terminal [Island Jetty] with sub-sea pipeline has been selected

- Island Jetty with sub-sea pipeline in the offshore region and trenched pipeline in the onshore region is the most environmental friendly option
- This option involves minimal pollution /leakage risks due to absence of flexible hose elements
- No obstruction to littoral drift leading to erosion/sedimentation and spit formations.
- No interference with mobility of fishing trawlers / vessels.

1.3.2.2 Components of the marine terminal

The Marine Terminal Facility comprises of Island Jetty, Sub Sea Pipeline and an Onshore Pipeline for transfer of VCM from the Ship to the PVC Plant site.

- Island Jetty
- Unloading arm connecting ships manifold and VCM pipeline
- 12" dia submarine pipeline (1.0 km long) / onshore sub terrain pipeline (2.5 km long) to the PVC plant.

The selected marine terminal facility for importing VCM is planned to receive 10,000 DWT fully loaded vessels and 20,000 DWT partially loaded vessels. No dredging is required for the proposed marine terminal

The onshore pipeline from the landfall point to the PVC plant passes through sandy tracts covered with cashew trees often interspersed with casuarinas trees. There are no human habitations/ settlements or religious structures directly in the proposed pipeline corridor. The

pipeline crosses the Rajapettai Road, Naduthittu- Nuchikadu Road, crosses the Uppanar canal and ends at the PVC plant.

1.3.2.3 Port crafts and Marine services

Port craft (Tugs, Pilot launches etc.) and marine services required for operating the marine terminal are proposed to be contracted to an experienced and qualified private operator for effective operation and maintenance. This is a standard and well-proven approach in India for such services.

2.0 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

2.1 Scope of ESIA

- ◆ Baseline Data Generation and collection
- ◆ Environmental and Social Impacts during Construction and Operation Phases
- ◆ Environmental Action Plan (EAP) comprising mitigation measures, monitoring program with related budgetary estimates.

2.2 Policy, Legal and Administrative Framework

The ESIA of the proposed PVC plant and the Marine Terminal facility is carried out in conformity with the current environmental regulations of Government of India (GoI), Government of Tamil Nadu (GoTN), TNPCB and the World Bank Group.

2.3 Statutory clearances

The PVC plant requires a No objection Certificate (NOC) from Tamil Nadu State Pollution Control Board (TNPCB) and Environmental Clearance from Ministry of Environment & Forests (MoEF), a body under Government of India.

The Marine Terminal Facility requires CRZ clearance from Coastal Zone management Authority, a body also under MoEF through Department of Environment and Forests, Government of Tamil Nadu.

2.4 Baseline Environmental Status

➤ Study Area

A study area of 10Km and 25km radius has been considered to delineate the baseline environmental status for onshore & offshore environment, and also for socio-economic aspects. The study was carried out during the pre & posts monsoon seasons respectively for the marine terminal the PVC Plant during the year 1999. The

baseline monitoring for air, water, noise and soil were carried out within 10km radius where as the secondary data on socio-economic aspects has been collected within 25kms.

In addition to this secondary data for winter, summer and pre-monsoon seasons of the recent years (1993-2000) have been collected from the TNPCB library and compiled to assess the environmental conditions of the study area for onshore and offshore environments for different years.

➤ **Climate**

The climate in the area is tropical. It is neither extreme hot nor extreme cold but experiences high humidity. Monthly mean temperature ranges from 17.7 to 40.5 °C. The maximum and minimum temperatures observed during the study period are in the range of 30-37 & 15.5-22 °C respectively.

Rainfall (annual average 1300mm) in the area is mostly from NE monsoon between October to December. Predominant wind direction during summer is SSE, NE & NNE during premonsoon. The relative humidity ranges between 50-97%. The wind speed varied between 0.1 to 13.5 km/hr.

Onshore Environment

➤ **Air Environment**

Ambient air quality was monitored at five locations during the pre and post monsoon season. The concentration level of SPM, SO₂, NO_x, Ammonia, HC, CO and Fluorine were monitored in the study area. The concentrations recorded at all the five monitoring locations for the pre & post monsoons are observed to be within the stipulated limits of National Ambient Air Quality Standards (NAAQ).

➤ **Noise Levels**

The noise levels were found to be varying between 55-65 dB (A) during day and 48-61dB (A) during nighttime.

➤ **Water Quality**

The surface water (Uppanar) indicated slight alkaline nature and concentration all the other parameters are found to be high. Sub surface water indicated neutral nature with absence of coliform bacteria. The contamination levels in ground water are observed to be minimal.

➤ **Soil quality**

The soils are acidic to neutral in nature with high permeability and low water holding capacity.

Offshore Environment

➤ **Marine Water**

The pH and Salinity values of marine water at all the sampling locations were more or less had similar trend with no significant variations. Heavy metals are observed to be below detectable levels. Parameters like chloride and sulphates were observed to be that of normal seawater.

The important Phytoplanktons recorded in the project area are Bacillariophyceae, Dinophyceae, Cyanophyceae, and Chlorophyceae.

Zooplanktons recorded in the project area are Ciliate, Siphonophora, Rotifera (*micro Zooplankton*), Polychaete (mud worm), Cladocera, Copepoda, Cirripeda, Mysidaceae, Amphipoda, Cumaceae, Decapoda, Eucopipoda, Chaetognatha, Hydrozoa (*medusae*), larvae and other forms.

➤ **Marine Sediment**

The sediment texture was found to be sandy with a mixture of silt, clay and shells. Among the Benthic communities Nematodes (*unsegmented worms*), Molluscs (*single shelled animals*) and Polychaete are observed to be dominant groups.

An appraisal of all the available /compiled secondary data indicate that the past Ambient air quality, noise levels and water quality (surface and sub surface) of the region has been more or less consistent in the recent past years and the data recorded during the present studies is also in general conformity with the past data irrespective of the seasons.

Socio-Economic Aspects

➤ **Population details –Study area**

An area within a 25 km radius of the project was established for the assessment of the project's socio-economic impact. There are about 65 villages within this area which includes the sub-districts of Cuddalore, Chidambaram and Panruti Taluks and urban areas such as Cuddalore, Nellikuppam, Neyveli and Panrtui.

The total population of the study area is 1,162,835 having a literacy rate of 56.5%. The predominant occupation is agriculture followed by agricultural labor and fishing.

The population with in the immediate vicinity of the project i.e. 3km radius is around 28695 with a literacy rate of 40%.

➤ ***Profile of fishing communities – Cuddalore Coast***

The total population of the fishing villages in Cuddalore District is 40,582, of which approximately 14,000 people are actively engaged in fishing. Among this group, 25% has an annual income of less than Rs 3,000 43% has an annual income between Rs.3,000-6000,, 27% has an annual income of Rs.6,000-12,000, and 5% has an income of Rs.12000 or more.

Profile of fishing communities – in Marine Terminal vicinity

The nearest fishing villages in the vicinity of the marine terminal site are Chitterapettai, Tamannapettai, Rajapettai and Sothikuppam. The fishing is carried out by traditional methods through use of catamarans. The number of active fishermen in these villages totals 1,303.

2.5 Environmental and Social Impacts

The assessment of impacts during the construction and operation phases of the PVC plant and the marine terminal facilities have been studied for the onshore and offshore environmental attributes.

2.5.1 Environmental and Social Impacts –Construction phase

Air Environment

During the construction phase of the PVC plant, island jetty and laying of onshore & offshore pipelines, emissions from diesel run dozer(s) and grader(s) involved in site clearing operations, DG sets, vehicles carrying construction material, diesel run propeller(s) of barges, work boats and dredgers may contribute to localized deterioration of air quality. The parameters affected will be suspended particulate matter, hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxides (NOx).

The construction materials for the PVC Plant will be brought by road transport. For the marine terminal will be brought by trucks to Cuddalore port, loaded onto barges and transported to the project location. This activity would increase the traffic along the roads leading to the port and also along the NH-45A. The increase in the particulate matter and gaseous pollutant due to the increased traffic are temporary and are not significant limited to the construction phase.

Noise Environment

The construction activity for the PVC plant mostly involves civil works such as site clearing, grading, and installation of equipment where as for the marine terminal it involves construction of island jetty and offshore & onshore pipeline. The increase in noise levels will be marginal and will be localised. Further the operations of the marine terminal are not likely to result in neither loss of habitats, feeding grounds nor emit extremely variable and unpredictable sounds as no fishing grounds, spawning areas are there at the project site. Hence, impact due to increased noise level on the aquatic fauna will be insignificant. However there will be slight increase in ambient noise levels along the NH45A and Cuddalore Port road due to the construction material movement.

Water Environment

Inland environment

During the construction runoffs from worker camps, material storage areas and disposal of excavated material may have impacts on the inland water quality. Measures will be taken to minimize the risk of such impacts. The water of the Uppanar is saline and therefore not used for potable supply. Community usage is also limited (e.g. transportation, fisheries).

Marine Environment

The off shore construction stage will generate several marine impacts, including physical & chemical disturbance, input of substances into water column, removal of substances & biota from bed and uptake of pollutants during underwater trenching.

Turbidity is regarded as an indicator of impacts and limiting turbidity will significantly mitigate impacts induced by underwater trenching/dredging operations.

The sediment characteristics in the project region indicate faster settlement characteristics. Therefore mitigative measures are expected to be very effective in containing turbid levels and also related impacts. Moreover, the aquatic environment along East Coast including the project region is subjected to significant variations in turbidity, due to natural and recurring phenomena of littoral movement. Therefore the marine aquatic environment should be able to sustain a short-term increase in localized turbidity during the construction stage.

Testing of facilities

Prior to commissioning, the sub sea pipeline will be subjected to hydraulic testing using seawater. The seawater used for hydrostatic testing is normally treated with biocides, scale inhibitors and oxygen scavengers as anti fouling measure. The environmental concerns of anti fouling measures are toxicity levels of biocides and oxygen depletion in receiving water bodies. Given the one time discharge (400 cu. m.) to sea, prevailing currents, potential for dispersion and mixing in seawater, the impacts arising out of these are transient in nature.

Land Environment

The proposed PVC plant is being located in a notified industrial area developed by SIPCOT and is classified as Hazardous Chemical Zone. The project site is barren with no agricultural activity in the land. There will also be no impacts along the area identified for the onshore pipeline corridor as it is proposed on sandy tracts.

Therefore there are no impacts envisaged on the land environment.

Socio-economic impacts

The proposed PVC plant is being set up in notified industrial estate. As such, no resettlement is associated with the project. A previously purchased parcel of land of approximately 20 acres will also be included in the total plot. On the boundary of this land is an old rest house (a basic shelter for those using the adjacent road). As part of the project, Chemplast and the rest house owner have agreed that the present structure be demolished and a new structure be erected within 1 km of the present location. This will be done at Chemplast's cost.

There is no loss of livelihood or income to the fishing communities as no fishing grounds / spawning areas are located in the marine terminal site. There is neither hindrance to the movement of fishing crafts nor decline in fish population.

The land acquisition process intended for laying the onshore pipeline is not anticipated to generate any adverse socio-economic impacts. The land is not of high agricultural, ecological or cultural value. Loss of cashew trees along the pipeline corridor if any, will be compensated by planting new trees. The landowners would be suitably compensated with respect to the prevailing market prices. The corridor route has been determined in conjunction with local communities and routed to avoid any direct impacts on settlements.

2.5.2 Environmental and Social Impacts –Operation phase

The impacts during the operation phase of the PVC plant and the marine terminal facilities area assessed under the following heads;

Air Environment

Impacts on the air environment will be mainly due to the emissions from the process and utilities. Process emissions will include VCM & particulate matter emissions and HCl containing flue gases from incinerator. These will be mitigated through use of the following technologies and techniques.

- The unreacted VCM will be recovered in the VCM recovery section. After recovery, the balance VCM containing emissions will be incinerated. Incinerator flue gases will be scrubbed with NaOH solution to eliminate HCl.
- High efficiency cyclones will be provided to remove PVC particles from the dryer exhaust. Wet scrubber will be installed on the exhaust to further reduce the particulate content.
- Reverse jet filters will be provided to remove dust from the bagging area.
- Fugitive emissions will be controlled by providing double mechanical seals on pumps, compressors, agitators and reactors.
- High quality leak tight valves and gaskets will be provided and rupture disc will be provided before pressure relief valve.
- Closed testing facility will be provided.
- VCM levels in the working areas will be monitored continuously.

As a result of these measures, the plant, when operational, will meet the emissions requirements of the local Pollution Control Board and the World Bank Group.

Utility emissions include emissions from the DG stacks and a common stack provided for boiler and incinerator.

The emissions from boiler and DG sets will include SO_x, NO_x and Suspended Particulate Matter. These will be mitigated through the use of the following technologies and techniques:

- No_x and particulate emissions from boiler will be controlled by high efficiency burners, effective burner management system and similar advanced combustion techniques. Sox will be controlled by the use of low sulfur fuels.
- Required stack heights will be provided to utility stacks to ensure proper dispersion of these pollutants so that the ambient air standards are complied with.

- The ambient air quality will be regularly monitored for these parameters to ensure that they are within acceptable limits.

The ground level concentrations predicted for VCM, SO₂ & NO_x compounded with the respective baseline values are in compliance with the National Ambient Air Quality standards thereby not having any significant adverse impacts on the air environment.

Significant process emissions during the operation phase of the marine terminal facilities would occur only if there was an accidental leakage /spill due to equipment failure or damage. The design and construction methods chosen for the marine terminal and pipeline are intended to minimize this risk - the entire VCM unloading is designed to be leak roof and a SCADA system is proposed to detect the leakage if any, at an early stage, during the transfer of the product and allow take corrective action to be taken. The ESIA and Risk Analysis Report provide more detail.

Water Environment (inland and marine)

The water requirements for all the industries which are established in SIPCOT industrial area (Phase I and Phase II) are being met by SIPCOT including for the proposed project. Hydrogeological studies conducted by SIPCOT indicated no depletion in ground water levels to date.

The quantity of wastewater estimated from the PVC plant is about 2,834m³ per day. The effluent characteristics are in compliance with the MINAS standards and will be discharged into the marine environment through a diffuser system. The effluent disposal area in the marine environment has been identified through modeling studies, which is located at 7m-depth contour close to the shore. The estimated residual VCM concentration in the treated water is around 0.5mg/l which will not have any significant adverse impacts on the marine environment, as the diffuser is not located in any fishing ground nor spawning areas.

Further if VCM gets released into aquatic environment in the event of any leakage/spill during the product transfer, it rapidly volatilizes as VCM has low solubility in water. USEPA has reported a half-live life of 0.805hr for VCM in water. VCM has a Bio Concentration Factor (BCF) of 7 indicating that it will not significantly bio-concentrate in aquatic organisms.

Impacts on fisheries

No significant impacts on the fisheries is envisaged due to the disposal of treated effluent from diffuser and leakage/spill of VCM during transfer from ships to the plant as the location of the diffuser and the marine terminal are not located in active fishing grounds.

Land environment

There will be no change in the land use pattern due to the PVC plant as it is being set up in notified industrial estate. The laying of onshore pipeline trench will require clearing of few cashew and casuarinas trees in the identified private lands.

Further if Vinyl Chloride gets released to soil due to accidental leakage /spill during the product transfer, it will undergo rapid volatilization with reported half-lives of 0.2 and 0.5 days for evaporation from soil at 1 and 10 cm incorporation, respectively.

Solid wastes

No significant impacts on the land environment are anticipated as the solid wastes generated from the PVC plant i.e. PVC lumps from the reactors, which are termed to be hazardous are small in quantity and will be disposed in a secured landfill. PVC Solids from the ETP are saleable and could be used for non-critical applications.

Impacts on Flora and Fauna

No significant impacts on terrestrial flora and fauna are envisaged due to release of VCM into atmosphere as VCM degrades into the atmosphere rapidly. Also, the pipeline carrying VCM is a high integrity system eliminating possibilities of leak.

Thus the release of VCM into ambient air, aquatic environment and soil/sediment is therefore not likely to cause significant impacts due to the inherent rapid decomposition characteristics of VCM. The detrimental effects are significant only if humans are exposed to VCM.

Human Exposure to VCM

Human exposure may only occur in situations where large amounts of VCM are accidentally spilled to the environment. During normal handling, unloading and transmission of VCM there is a very remote chance of exposure of the general population to VCM as the entire transmission system is proposed to be leak proof. The Risk Assessment Report and Disaster Management Plan provide further detail.

2.5.3 Positive Impacts

- Employment opportunities during construction phase will be available.
- Long term benefits can be accrued through the employment opportunities in industrial, secondary and tertiary sectors not only due to the PVC plant and the marine terminal but also other

industries that are existing and/or being planned in and around the PVC plant.

- Increase in the revenue by the way of direct / indirect taxes to the authorities.
- The commissioning of the PVC plant and marine terminal facilities will contribute to the economic growth of the district / region /state.
- Upgrading of the existing roads /infrastructure due to the developments.

3.0 Risk Assessment

Risk assessment and consequence analysis carried out for storage of hazardous chemicals in the PVC plant and unloading / transmission of VCM from marine terminal indicate that the levels of risk due to the storage of hazardous chemicals and handling of VCM do not exceed the general risk of comparable activities. As a part of the risk assessment an onsite disaster management plan has been prepared to address all conceivable disaster scenarios associated with the project.

4.0 Environmental Action Plan (EAP)

An Environmental Action Plan (EAP) for installation, testing, commissioning and operation phases of the PVC plant and the marine terminal facilities have been drawn up to mitigate the identified impacts.

In operation stage, monitoring of ambient VCM concentrations, evolving a health profile directory and conducting periodic assessment of work personnel health for known health hazards of VCM has been recommended. This will pave way for providing early warning to limit health risks, if any in case of detrimental exposure of VCM in work places.

For effective disposal and dispersion of treated effluents a marine out fall has been proposed at 7m depth in the open sea through modeling studies. Also monitoring of the secured landfill, mechanism for disposal of effluent treatment plant (ETP) wastes and maintenance of records pertaining to raw material consumption has also been recommended. A green belt development plan covering an initial area of 28, 602m² is proposed in the PVC plant as a part of the mitigating measures.

The EAP also includes a schedule of environmental monitoring for ambient air, water (inland and marine), noise, soil, & flue gases, budgetary estimates, institutional mechanism, integration with the project activities, the implementation schedule and public

consultation/social impact assessments. The results of the monitoring program will be compiled which will serve as a management tool to minimize impacts and promote environment or social opportunities during the construction and operation phases.

In addition to these it is also proposed to provide necessary marine warning systems and emergency responsive systems as safety measures on the Island Jetty and also to the local populace in the event of any unforeseen disaster.

The marine warning systems include automatic weather station, leak detection alarms, illumination and the emergency responsive system includes communication facilities, public address systems, hotline facilities with the local district administration and additional vehicles for evacuation.