# EXECUTIVE SUMMARY

## 1. INTRODUCTION :

VCM Vinyl Choride Monomer (CH2=CH CL) is the building block for its polymer - Poly Vinyl Chloride (PVC) and other co-polymers with acetate and Vinylidine chloride. On an industrial scale VCM is handled as liquid under pressure.

VCM is reported to be carcinogenic and is an OSHA regulated material.

More than 95% of VCM is used as a precursor to PVC, the versatile plastic material. The co-polymers PVAC and PVDC also find specific applications and have gained importance.

## 2. PROCESS

(I) The industrial production of VCM started in early fourties in the UK, USA and Germany and thereafter multiplied rapidly reaching the current capacity that of 20 M MTA. The predomenant feedstock is ethylene derived from a cracker or from alcohol. Others are acetylene and mixed gases much as ethylene and acetylene from flame cracking.

(II) The Processess are :

A. Hydrochlorination of acetylene

B. Balanced process based on ethylene consisting of steps:

Direct chlorination, Oxychlorination and EDC Pyrolysis.

C. Kureha Process :

- Flame cracking of Naphtha (Kureha) to produce a mixed gas of Acetylene and Ethylene.
- Direct chlorination of Ethylene.
- Hydrochlorination with HCl from EDC cracking.

(III) The acetylene route is no more practised as carbide acetylene has become expensive. However, the Shriram plant at Kota is still using carbide acetylene. Another draw back is the toxicity problem associated with Mercury chloride used as a catalyst.

(IV) DCW Ltd operated a VCM plant in Tamil Nadu in early seventies on the flame cracking route. However, production could not be sustained and now the plant is importing VCM. The Japanese plants on this technology operated for about 16 years and were shutdown recently for economic reasons. Though the process is attractive in specific situations, the selection of this technology for a new plant has to be strictly on economic basis.

**(V) BALANCED ETHYLENE PROCESS:**

This is the most widely used process for VCM. The process steps indicated above are unrelated in a single plant so that there is no surplus HCL production.

The major variations offered by various licensors lie in :

(i) Air or Oxygen for oxychlorination.

(ii) Fixed bed or fluid bed for the oxyreactors.

(iii) Liquid or vapour phase cracker for cracking EDC.

(VI) The areas that need attention in the balanced processes is metallurgy of the reactors to deal with corrosion problems due to, hydrochloric acid, effluent water treatment, vent gas and liquid incineration. As the EPA standards are getting severe, the current trend is to go in for oxygen based systems to reduce vent gases. Incinerators are invariably added to deal with chlorohydrocarbon wastes.

## 3.0 STATE OF THE ART INTERNATIONAL

A list of country wise producers is tabulated. On the global scene, plants of 200-300 KTA are built in developed countries and there has been extensive reorganisation of company ownership to maintain profitability. The latest technology developments are focussing mainly on compliance with safety standards, reducing the utilities and energy requirements and increasing the conversion per pass.

## 4.0 STATUS OF INDIAN INDUSTRY

(I) In India, the growth of VCM plants has come up as a part of utilising the by-products of other units. The list of licensed and installed capacities of VCM plants in India has been compiled and presented. The largest capacity of VCM plant is at IPCL, Vadodara and is based on the balanced process. Since the balance process is based on ethylene which is not easily available, no plants with large capacities (Other than IPCL) have come up - The MES of 100,000 TPA is planned as part of integrated downstream plants, along with Naphtha (or) Gas cracker.

(II) The demand of VCM is directly linked to the demand for PVC. The PVC production, consumption and projected demand data are compiled. In 1989-90 there was a gap of about 125 KTPA between, production (137 KTPA) and consumption (262 KTPA) figures. The projected demand for PVC in 1994-95 is about 485 KTPA. About five PVC plants of 100,000 TPA capacity would be required by 1991-2000 A.D. to meet the supply demand gap.

The plant service factor achived in VCM plants are lower than other petrochemical plants, due to frequent breakdowns which are caused by the high corrosive nature of the plant. The product purity of VCM (reqd. for PVC production), as produced by Indian Manufacturers is acceptable. The list of licensors who have supplied technology is listed. No serious R&D efforts have been made by Indian Manufacturers to develop VCM process. The focus was mainly on loss reduction, yield improvement, energy conservation and modernization.

(III) A study of indigenous capabilities in process design was carried out and the results are summarised. Developing indigenous process design capability may not be cost effective. But by asking for only the critical design aspects from foreign licensors and utilizing Indian process design skills for other aspects, will certainly reduce the foreign exchange fee involved in technology transfer.

## 5.0 TECHNOLOGY ABSORPTION AND GAPS

Even though no serious steps been taken towards indigenization of basic process design of VCM technology, nonetheless the production technology has been fully absorbed as far as development of operational expertise is concerned. Detailed

Engg. for IPCL and NOCIL, plants were carried out in India. But adequate fabrication capability is not available in India for key items like oxy-fixed bed reactors, glasslined vap/liq. separators & teflon-lined vassels.

In India, since VCM is consumed captively for PVC manufacture, it is considered as an intermediate only. India is a net importer of VCM for which duty concession has been granted.

In International scene, since the basic process parameters, cataysts, etc. are well established by major licensors, the focus is mainly on energy integration & reducing the cost of production. Sublicensing has been required by IPCL, from Stauffer and future developments if any, would be available from IPCL, for commercialization.

## 6. RECOMMENDATIONS

(I) Vinychloride processes based on acetylene or mixed acetylene/ethylene streams are limited by local availability and relative costs of basic raw materials like limestone, naphtha and of utilities like power etc. Hence these were attractive in the past under certain geographic and economic conditions only. Under present day scenario of high cost of power and large demand/supply gap, only balanced VCM plant based on ethylene feedstock is expected to be attractive in India.

(II) Majority of VCM production facilities in India are very small in size compared to worldwide trend. To cover demand/supply gap, it would be worthwhile to put up new grassroot economic size plants rather then modernising or debottlenecking the existing plants in a big way. In any case, the expansions alone would not be able to meet demand.

(III) Up to date technology for VCM manufacture is available at a reasonable cost from reputed licensors. This approach also involves least risks as the technologies are well tried out, making of course the best use of available capabilities and facilities in India .

(IV) Catalyst development for the oxychlorination steps need to be encouraged. Self reliance in catalyst is a desirable goal so as to sustain production from the existing/proposed plants in eventualities.

(V) Developing indigenous process design capability may not be cost effective. Process engineering contributes about 70% of effort in basic engineering

package, while the process design contributes the rest 30%. As a result of considerable interaction with the licensors during basic and detailed engineering of recent VCM plants set up in the country, a certain degree of competence has been achieved in process engineering of these plants. Hence, for all future plants, process engineering be carried out by an Indian engineering company based on the basic process design made available by the licensor and this aspect need to be negotiated.

(VI) In case the licensor is an established technology source from abroad, the import content may be kept to the minimum by seeking only the critical aspects of the technology.