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INDUSTRY BRIEFING OF EPA TASK GROUP ON VINYL CHLORIDE

~~600-PJW~~ ✓

PANEL SESSION NO. I

The VCM/PVC Industry

My name is Benj. M. G. Zwicker, Director - Technical Planning for the B.F. Goodrich Chemical Co., Cleveland, Ohio. My responsibilities include planning for longer range technological needs to meet new societal and economic requirements. In this capacity I was involved with the transition in our Company from acetylene-based vinyl chloride in the 1940's to present ethylene-based processes during the 1960's.

As you probably already know, vinyl chloride (VCM) is chemically 1-chloro ethylene, molecular weight about 62.5, a gas at ambient temperature with a density vs air of about 2.1. Detailed physical constants are well documented in the technical literature. Specific solubility properties in water and PVC will be discussed in Panels III and IV.

Commercial production of VCM in the USA started in the 1930's. The need for flame-retardant electrical insulation for military equipment during World War II mobilized production plants for PVC so that by 1945 USA production reached 100 million lbs.

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All of the VCM required for these operations was made by the anhydrous and essentially quantitative addition of HCl to acetylene over a carbon catalyst containing mercuric chloride.

All of the acetylene was derived from reaction of calcium carbide with water. (This produced 1.2 lbs. of hydrated lime per lb. of VCM plus the water with slurry.) Calcium carbide was made from an electric furnace reaction of coke and lime or limestone. This reaction emitted large quantities of carbon monoxide and particulates. The HCl was either made by burning chlorine and hydrogen or from by-product materials from other chemical processes.

By 1950, VCM production had reached 430MM lbs. in the USA with three integrated producers, mostly based on carbide acetylene. We shut down our last VCM plant based on carbide acetylene in 1967 at Louisville, Kentucky. During the 1950's, some quantities of vinyl chloride were made from petroleum-based acetylene. In this process, natural gas or light hydrocarbons are partially burned with oxygen at a high temperature to produce a mixture of acetylene and carbon oxides and hydrogen. Two VCM plants are still in operation based on petroleum acetylene.

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Most of the 5.3 billion pounds of VCM production in the USA in 1973 were made by cracking ethylene dichloride at high temperatures. The ethylene dichloride is made in two ways:-

- (1) Ethylene is reacted with chlorine at low temperatures - an almost quantitative reaction.
- (2) The by-product HCl from the cracking (or other chemical processes) is catalytically reacted with ethylene in the presence of oxygen to very high yield on both reactants.

Some by-product chlorinated hydrocarbons, both lighter and heavier than EDC are produced during the above operations. In our Calvert City plant these average less than 2 lbs. of by-products per 100 lbs. of VCM produced. We have been burning these by-products at a high temperature and recovering the HCl for recycle. We will be starting up a new process this year that catalytically burns the material at a moderate temperature so that less fuel will be required and the heat of combustion can be used for process steam. Overall material balance on chlorine to vinyl chloride in the tank car is about 99.5% and on ethylene is about 95%, most of the loss being as carbon oxides from the oxidation reactors.

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