
OAR Box 1178

Prepped by Ryan Dugan

Document Number:

26) II-A-13

Docket Number:

A-90-49

A-90-49

II-A-13

SOURCE ASSESSMENT OF ETHYLENE DICHLORIDE EMISSIONS

FINAL REPORT

EMISSION STANDARDS AND ENGINEERING DIVISION

Prepared by

R. Dwight Atkinson
Styron N. Powers
Richard C. Cooper
Michael D. Maul
W. T. Moody

U. S. Environmental Protection Agency
Emission Standards and Engineering Division
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

September 1984

PREFACE

This report has been prepared to describe work performed by Midwest Research Institute (MRI) under EPA Contract 68-02-3817; MRI Task 7710-L, for developing a source assessment for ethylene dichloride emissions. This report has been prepared in accordance with directions provided by the Emissions Standards and Engineering Division, Office of Air Quality Planning and Standards.

APPROVED BY:
MIDWEST RESEARCH INSTITUTE

Lloyd T Taylor
Lloyd T Taylor, Director
North Carolina Office
September 21, 1984
Date

2. CHEMICAL PLANTS

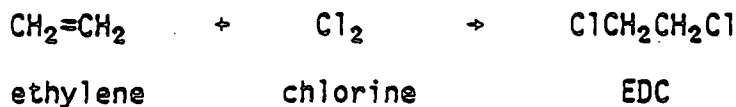
2.1 ETHYLENE DICHLORIDE PRODUCTION AND USE

Ethylene dichloride (1,2-dichloroethane) is a clear, colorless, oily liquid with a chloroform-like, sweet odor and taste.¹ Ethylene dichloride is used as a raw material in the production of vinyl chloride monomer (VCM), various ethyleneamines, methyl chloroform (1,1,1-trichloroethane), ethyl chloride, trichloroethylene (TCE), and perchloroethylene (PCE). Its physical properties are presented in Table 2-1. The major domestic producers and users of EDC are listed in Table 2-2. The consumption of EDC is summarized in Table 2-3. Production of EDC and its use in other chemical production processes are discussed in Section 2.1.1 through 2.1.6. Emissions of EDC at chemical plants come from five primary sources: process vents; equipment leaks; secondary sources; storage tanks; and truck, rail car or barge loading. These emission sources and applicable control technologies are discussed in Sections 2.2.1 through 2.2.5, respectively.

2.1.1 Ethylene Dichloride Production

Ethylene dichloride is produced in the United States by direct chlorination of ethylene, oxychlorination of ethylene, or a combination of these methods. Also, one corporation reported production of about 2 million pounds per year of EDC as a byproduct of the manufacture of a fire retardant for urethane foam.

Direct chlorination of ethylene is accomplished in either the liquid or vapor phase according to the catalytic reaction:²



4. PHARMACEUTICAL MANUFACTURING PLANTS

4.1 ETHYLENE DICHLORIDE SOURCES AND EMISSIONS

Ethylene dichloride is one of many solvents used in the manufacture of synthetic pharmaceuticals. Pharmaceuticals are typically made in a series of batch operations, many of which involve the use of solvents. These operations include reactors, distillation systems, filters, extractors, centrifuges, crystallizers, dryers, and various holding tanks. Solvent emissions can occur in any of these process steps, and can also occur from solvent storage, transfer, and recovery systems. Solvents may be used as a reaction medium, to dissolve an intermediate product prior to a process step, to wash an intermediate or final product, or as a drier after a water-based production step.¹ No information was obtained on specific locations, applications, or emission points for EDC use in the pharmaceutical industry. The magnitude of gathering such information was beyond the scope of this study.

In May 1984, the Pharmaceutical Manufacturer's Association (PMA) solicited information from member companies on their use of four solvents, including EDC.² The EDC purchase, emission, and disposal statistics provided by the member companies are presented in Table 4-1. Responding companies account for about half of the 1982 domestic sales of prescription pharmaceuticals. However, the PMA indicated that some manufacturers may not have responded to the survey because they do not use any of the four solvents. Thus, the numbers may not accurately represent the actual ratio of EDC use to pharmaceutical sales and the doubling of the estimates in the responses (as is done in Table 4-1) may result in overestimation of true EDC purchase and losses for the entire industry.

6. MISCELLANEOUS USES AND EMISSION SOURCES

6.1 ETHYLENE DICHLORIDE SOURCES AND EMISSIONS

Minor uses of EDC are in textile cleaning and processing, in coatings, in formulations of acrylic-type adhesives, as a product intermediate for polysulfide elastomers, as a constituent of polysulfide rubber cements, in the manufacture of grain fumigants, and as a cleaning and extraction solvent.¹ These minor uses accounted for only 0.1 percent of the EDC produced in 1983. Of the estimated consumption of EDC by minor uses, about 28 percent is used in the manufacture of paints, coatings, and adhesives. Extracting oil from seeds, treating animal fats, and processing pharmaceutical products (discussed in Chapter 4) account for 23 percent. An additional 19 percent is consumed in cleaning textile products and PVC manufacturing equipment. Nearly 11 percent is used in the preparation of polysulfide compounds. Grain fumigation requires about 10 percent. The remaining 9 percent is used as a carrier for amines in leaching copper ores, in the manufacture of color film, as a diluent for pesticides and herbicides, and for other miscellaneous purposes.² Some of these uses are discussed below.

Estimates of EDC emissions from the miscellaneous uses are provided where possible. No information was obtained on specific emission points for EDC. The magnitude of gathering such information was beyond the scope of this study. To estimate the cost of controls and emission reductions achievable, specific study of these industries will be necessary.

6.1.1 Paints, Coatings, and Adhesives

A study performed by the EPA's Office of Air Quality Planning and Standards estimated that about 1,400 Mg of EDC per year (1,540 tons/yr)