

THE DETERMINATION OF VINYL CHLORIDE

A PLANT MANUAL

ANALYTICAL METHODS REQUIRED FOR THE CONTROL OF VINYL CHLORIDE CONCENTRATIONS IN AND AROUND MANUFACTURING AND PROCESS PLANTS

Compiled by specialists convened by
the Vinyl Chloride Committee of the
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* N.B. More detailed Tables of Contents for these Chapters precede the Chapters.

PREFACE TO THE THIRD EDITION

This manual is the work of one of the four specialist groups convened by the Vinyl Chloride Committee of the Chemical Industries Association Ltd., i.e. The Analytical Methods and Monitoring Procedures Group.*

The Vinyl Chloride Committee is composed of representatives of the Chemical Industry Safety and Health Council of the Chemical Industries Association, of the British Plastics Federation and of the four member companies of the Chemical Industries Association that manufacture VCM and PVC, namely British Industrial Plastics Ltd., BP Chemicals International Ltd., Imperial Chemical Industries Ltd. and Vinatex Ltd. (who account for all the UK production of VCM and its UK conversion to PVC). Its primary concerns are:—

- a) to clarify the nature and extent of the hazard to health of vinyl chloride,
- b) to establish, in collaboration with UK Government Departments and other expert bodies in the UK and overseas, the conditions and actions necessary to safeguard the health of personnel making or using vinyl chloride or processing materials made from it,
- c) to promote the speedy implementation of any necessary action.

The Committee's immediate objective is the lowest practicable atmospheric concentration of vinyl chloride in all UK VCM and PVC plants. Substantial progress towards this aim has already been achieved through the work of the Committee's Works Practices Group. The analytical methods developed for and described in this manual plus the instruments being developed under the Committee's sponsorship represent further steps forward in the achievement of this aim.

The Third Edition includes five new Standard Methods and ten Analytical Notes which were not contained in the Second Edition. In addition the opportunity has been taken to alter the layout of the Manual (particularly Chapter 2), to update certain methods to take account of the change in the hygiene standard made late in 1975, and to remove a number of inconsistencies of presentation which appeared in previous editions. A new page numbering system has been adopted but the numbering of the Standard Methods and Analytical Notes is consistent with other editions. Where a change has substantially affected the technical content of an item it has been given a new issue number. If the technical content is not substantially affected by an alteration the item is indicated as having been revised.

* The other three groups are concerned with Health Aspects, Works Practices and Customer Liaison.

CHAPTER 1

INTRODUCTION

GENERAL

This book presents the best analytical methods currently available for ensuring that VCM and PVC production plants and PVC processing plants are operated in conformity with UK official hygiene standards.*

It has been produced by a group of specialists on analytical methods and monitoring procedures convened by the Vinyl Chloride Committee of the UK Chemical Industries Association Ltd. in conjunction with The British Plastics Federation.

The present composition of the specialist group is:—

Dr. P. Kane
Mr. H. Lawes
Mr. H. Lowe
Dr. T. MacEwan
Dr. L. McGinty
Mr. W. Thain (Convenor)
Mr. F. Whitlock

The group wishes to acknowledge the contribution made to the preparation of this book by many analysts from the UK PVC manufacturers, who have devised, tested and evaluated analytical methods and prepared them in a form for publication in this book.

ARRANGEMENT OF THE MANUAL

This edition is divided, as were the first and second editions, into four chapters. Chapters 3 and 4 are similar to the equivalent chapters in the previous editions and again are both preceded by tables of their contents. Chapter 2, however, has a new form, which is described below.

The loose leaf format has again been adopted to facilitate updating as requirements alter and new developments are made; to assist this each Method in Chapter 3 and Note in Chapter 4 is dated and carries an issue number. In previous editions the pages were numbered serially from beginning to end of the Manual. This system created difficulties when new methods were added and so a new numbering system has been adopted. In each chapter the pages are numbered from the beginning of the chapter and the page number is preceded by the chapter number. Thus new methods can be added at the end of a chapter without affecting the page numbering sequence.

Chapter 2 in previous editions contained a list of all the measurements of VCM likely to be required to ensure safety on different types of plant. Details of the environment in which the measurements have to be made, the likely range of the measurement and the accuracy which was required, were also included. These details are omitted from Chapter 2 in this edition which consists of a brief account of the philosophy of monitoring now adopted in UK plants, followed by a list of the various measurements which may be required for each of the five areas of application. The fifth area, VCM in foods which have been in contact with PVC, is new in this edition. The five areas of application, which are further subdivided as necessary to deal with requirements within and external to the plant, are:—

VCM Plants (Prefixed by letter M)
PVC Plants (Prefixed by letter P)
PVC Conversion Processes (Prefixed by letter C)
The Environment outside the Factory (Prefixed by letter E)
VCM in Foods which have been in contact with PVC (Prefixed by letter F)

* Analytical methods that may be necessary for other purposes in these plants, e.g. control of flammability hazards or product quality fall outside the scope of this book.

For monitoring purposes, handling and transport operations are considered part of the appropriate manufacturing process.

Against each analytical application is stated the reference numbers of the Standard Methods (Chapter 3) and Analytical Notes (Chapter 4) which are relevant to that particular application. For certain measurements more than one technique is available. Within the descriptive part of the text which precedes the procedure of each method will be found information on accuracy, instrumental requirements, etc., of the methods which will assist in choosing the method most appropriate for given circumstances.

Chapter 3 presents the Standard Analytical Methods recommended. It is a compilation of analytical methods which have been tested and agreed by the companies' analysts. Each standard method has a unique number preceded by the letters SM, and Standard Methods which appeared in previous editions retain the same number. The calibration procedure for each method is described either in the text or in an appendix to the description of the method. Experienced analysts will recognise where changes may be made to the methods described without affecting the validity of the results.

Chapter 4 is a compilation of notes on analytical methods, instruments, procedures and services which have not the status of standard analytical methods but which, in the Group's view, provide useful information for plant staff and analysts. Each note is numbered and preceded by the letters AN. Where a Note appeared on a subject in the previous editions the Note on that subject has been given the same number though it may be considerably changed in this edition.

HYGIENE STANDARD FOR VCM EXPOSURE

The Health and Safety Executive publication "Vinyl Chloride — Code of Practice for Health Precautions" states that no-one should be exposed to concentrations of vinyl chloride vapour greater than the hygiene standard which is defined as "a ceiling value of 30 ppm and a time weighted average of 10 ppm allowing that wherever practicable exposure should be brought as near as possible to zero concentrations".

ABBREVIATIONS AND CONVENTIONS

VCM Vinyl chloride monomer
PVC Polyvinyl chloride

The concentration of VCM in atmospheric samples is measured as parts per million volume/volume, which is abbreviated to ppm: Very low levels of concentration are expressed as ppb (parts per billion) where 1 ppb = 0.001 ppm. The units of measurement of the concentration of VCM in other samples are indicated in the text.

Atmospheric concentrations of VCM can change rapidly and so the value found can be highly dependent on the time over which a sample is taken. Certain analytical methods are designed to take samples averaged over a certain time and this is made clear in their description. Instantaneous concentrations can only be measured by a device having an infinitely short sampling time. This is usually not practicable and techniques are described which have the shortest possible sampling time. Such techniques are described in the text as "snatch sampling".

The Code of Practice referred to in the text is:—

Vinyl Chloride — Code of Practice for Health Precautions

published by:—

Health & Safety Executive,
Baynards House,
1 Chepstow Place,
Westbourne Grove,
London W2 4TF

SAFETY

The tests described in the Manual should be carried out only by persons trained in their use and under properly controlled conditions. Special precautions which should be observed in certain tests are described in the text.

Electrical safety specifications, where quoted, are as defined in the terminology recommended by the International Electro-technical Committee Publication 79-10. "Intrinsically safe" means that the equipment so described is constructed in such a way as to comply with the requirements of an intrinsically safe system as defined in British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA) Standard SFA 3012:1972 and certified accordingly by BASEEFA. Equipment which is certified by organisations in other countries does not necessarily comply with these requirements.

CHAPTER 3

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