

Safety in the
Chemical Industry

Safety in the Chemical Industry

Lessons from Major Disasters

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and

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Dedicated to Vivek Smita

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*To safety engineers, safety managers and
their like, whose mission in life is to
make chemical and process plants*

SAFE

SAFER

THE SAFEST

for their fellows and for themselves

Preface

The chemical process industry is noted for an excellent safety record, despite the fact that many of the materials it handles are extremely hazardous. Indeed, the standard maintained is substantially better than that in all the other major industries. However, the public image of the chemical industry sustained a severe blow following a series of disasters in 1984, culminating in the nightmare of Bhopal. So severe a blow was this to the industry that the slogan: 'Better things for better living *through chemistry*' has now been bereft of those last two words. Two years later the severe pollution of the Rhine following the fire at the Sandoz factory at Basle brought more adverse publicity to the industry through the media. Yet it remains true, and can be substantiated by detailed statistics, that the chemical industry is one of the safest of industries.

It is our thesis that the very accidents that bring the industry such a disastrous image and provide a continuing feast for the media are nevertheless the basis for continuing improvement in safety standards worldwide. The vital need to learn from the mistakes that others make has been a constant theme with us*. It is from the study and analysis of actual disasters that we can learn valuable lessons, which will help us to avoid similar accidents in the future. It is also true that safety should be of concern and

* *How to Learn from Project Disasters and Management Disasters and How to Prevent Them*, both published by Gower; *Corporate Failure*, published by McGraw-Hill and *Company Rescue*, published by Heinemann.

interest to those in positions of responsibility throughout the industry and not only to the experts. We have therefore written this book with the objective of more fully informing not only safety officers but technical managers, plant managers and operating staff, central and local government officers responsible for safety planning and the like, all of whom, while aware of the issues involved, desire to be ever better informed and equipped in order that they may do their jobs well.

We have therefore adopted an approach that is rather different from most of the existing books on the subject, in that we have made a study and analysis of past disasters central to our theme. Having introduced the subject of safety in Part One by considering the history of risk assessment and management and its lessons, we present in Parts Two and Three a series of case studies of major disasters that have occurred in the chemical industry during the current century, each of which brings its own specific lessons. Then we turn to apply the lessons we have learnt in Parts Four to Six, dealing with the three main areas: prediction, panacea and prevention. Finally, in Part Seven, we encourage our reader to listen to and learn from the case histories we have studied and their lessons. Hopefully some of these may 'echo' the personal experiences of our readers.

One major conclusion that comes out of our study of the disasters that have occurred in the past is that, while legislation and the legislators, with government inspectors, play a very important part, it is crucial that companies and their safety officers themselves adopt what we have called the 'self-policing' approach to safety. They know best of all what they are doing and the hazards that are involved. For their own sake they must not only seek to make their operations ever safer but they must also develop emergency plans to cope with possible disaster: plans that take into account both the workforce and the community in which they live and work. In most of the case histories we study, the community around the plant bore the brunt of the disaster. It is therefore mandatory, in our view, that the industry takes the public fully into its confidence: something it has been slow to do in the past. Unfortunately this reluctance seems to persist, usually under the guise of protecting proprietary know-how.

It is our hope that this book will contribute to increasing awareness of the risks that are inherent in the chemical industry and the steps that can and should be taken to minimize them. Since

accidents can never be eliminated completely, there will always be some risk: man is a frail creature and makes mistakes. If we have but brought to our readers the crucial significance of this one point – that there *is* such a thing as human fallibility and that it has serious consequences – then we feel we will have achieved our purpose. Man is far from perfect, but the system which he himself designs and operates under can be so organized that mistakes are less likely to occur, and the consequences of those that do occur are contained or minimized.

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Acknowledgements

The references listed at the ends of chapters not only provide a guide for those of our readers who want to research further into any particular topic discussed: they also represent an acknowledgement of our debt to the many researchers and commentators who have written on the various aspects of safety and hazard control that we touch upon in the course of this book.

A book such as this is by no means the product of we two alone, even though it bears only our two names. We have learnt much from our teachers, our co-workers and our students over the years. We are also most grateful to the many authors, listed separately in the author index, who are cited as direct sources in the references to individual chapters. It is their hard labour that has made this book possible. Special thanks are due to Dr Ian Swift of Blue Springs, Missouri, for permission to use several diagrams in Chapter 20, where we deal with emergency relief systems, and to the American Institute of Chemical Engineers for permission to reproduce some of their data. In this context we also wish to thank our publishers, Heinemann, and in particular our editor, Bridget Buckley, for advice and assistance in the development of the text.

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The University of Bombay

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The University of Aston in Birmingham
Lanchester Polytechnic (Coventry)

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Our families, and particularly our wives, Sudershan and Dorothy, have been pillars of strength, especially when things got difficult – as they do!

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