It is sincerely hoped that the information presented in this document will lead to an even more impressive record for the entire industry; however, neither the American Institute of Chemical Engineers, its consultants, CCPS Subcommittee members, their employers, nor their employers' officers and directors warrant or represent, expressly or implied, the correctness or accuracy of the content of the information presented in this document, nor can they accept liability or responsibility whatsoever for the consequences of its use or misuse by anyone.
The Center for Chemical Process Safety (CCPS) has recognized since its inception that enhancements in chemical process technologies, taken alone, are not sufficient to prevent catastrophic events such as Bhopal. It is obvious that successful chemical process management technologies need the commitment and participation of top management. Therefore, with support from its advisory and managing boards, CCPS established a multifaceted program to address the need for technical management commitment and technical management systems to reduce the potential for exposures to the public and to the environment.

The first document produced under the CCPS program was a brochure entitled “A Challenge to Commitment.” It provided an overview and an outline of a comprehensive model for the technical management of chemical process safety. The model is characterized by twelve distinct and essential elements. The overview brochure was mailed to more than 1500 CEOs.

The second publication was a book entitled Guidelines for Technical Management of Chemical Process Safety. It expands on the twelve elements of the CCPS model and provides both the framework and detailed components for a chemical process safety management system. It offers various alternative models for implementation of each of the elements and components of the model. To further supplement and “customize” the model, CCPS conducts training programs, based on the book, to teach the use of the CCPS process safety management program.

This book, the third publication, contains highly detailed instructions and example materials suitable for direct implementation at plants. Most of the example materials are taken from written procedures currently in place at some of the most prestigious U.S. plants. The guidelines in this book are directed toward all those individuals who are responsible for initiating and/or maintaining any of the elements detailed in Guidelines for Technical Management of Chemical Process Safety. To assist in the implementation of any or all of the safety procedures discussed in this book, in-depth training courses were developed by CCPS and are offered in AICHE's Continuing Education program.

The CCPS publications that cover the subject of chemical process safety management can be summarized as follows:

1. “A Challenge to Commitment” is an overview brochure directed toward CEOs and senior management
2. Guidelines for Technical Management of Chemical Process Safety elaborates on the CCPS process safety management program and is directed toward corporate middle management and plant managers.
2. *Guidelines for Technical Management of Chemical Process Safety* elaborates on the CCPS process safety management program and is directed toward corporate middle management and plant managers.

3. *Plant Guidelines for Technical Management of Chemical Process Safety* offers specific “how-to” materials for implementation at plants; it is directed toward plant managers, supervisors, and staff.

In the 1995 reprinting, Appendices 7G and 9A were added, and several revisions were made to reflect changes that have occurred since publication in 1992.
Acknowledgments

The purpose of this book is to provide examples of management systems for chemical process safety programs that are currently in place or that had been successfully used at chemical plants. The Center for Chemical Process Safety (CCPS) wishes to express its appreciation to the many CCPS sponsor companies that contributed plant programs for use in this book.

The CCPS Technical Management Subcommittee includes individuals who are recognized industry leaders in chemical process safety. Their contributions, dedicated guidance, and investment of time was essential to the publication of these guidelines. The Technical Management Subcommittee, under the chairmanship of Joseph C. Sweeney of ARCO Chemical Company, recognized that technology alone is insufficient to prevent catastrophic releases of hazardous materials. With the approval and support of the CCPS Technical Steering Committee, the Technical Management Subcommittee undertook the task of developing, preparing, and publishing materials for the technical management of chemical process safety. With the publication of this book, the subcommittee has completed its goal of publishing a triumvirate of materials for the technical management of chemical process safety.

"A Challenge to Commitment," a brochure for CEOs in the chemical industry, was the first publication. It was followed by Guidelines for Technical Management of Chemical Process Safety, which was directed toward middle management. This book, which provides examples of programs that can be used at plant locations, is aimed at plant managers, supervisors, and plant staff.

The CCPS Technical Management Subcommittee has assisted in the development of training courses to supplement Guidelines for Technical Management of Chemical Process Safety. The subcommittee will also assist in the development of a training program to supplement these guidelines.

The subcommittee wishes to acknowledge the assistance and suggestions made by peer reviews from Charles Dancer, Allied Signal; John Sharkey, Merck & Co., Inc; Jeff Fleming, Hercules, Inc.; W. Fast, PPG Industries, Inc.; I. Crawford Mackeand, ICI Americas; Robert Ormsby, Air Products & Chemicals; Gary Page, American Cyanamid; Chris Smith, Union Carbide; Steven Maher, Westinghouse; Mel Bode,
Rohm & Haas; Robert Cutro, Merck & Co., Inc.; and Dennis Hendershot, Rohm & Haas.

The Technical Management Subcommittee members are Joseph C. Sweeney, ARCO Chemical Company; Sanford Schreiber, CCPS Staff; Thomas A. Selders, ARCO Chemical Company; David W. Jones, Chevron Corporation; Stan Englund, Dow Chemical; Art Burk, Du Pont; John Dowbeldn, Exxon Chemical Americas; A. W. Bickum, The Goodyear Tire & Rubber Co.; Lewis J. Perfetti, The Goodyear Tire & Rubber Co.; William N. Helmer, Hoechst Celanese Corporation; Raymond L. Brandes, ICI Americas, Inc.; W. J. Fraser, Merck & Co., Inc.; Frank Ragonese, Mobil Oil Corporation; Dennis E. Wade, Monsanto Co.; Wayne E. Scheimann, NALCO Chemical Co.; C. R. West, PPG Industries, Inc.; John Gallmore, Dow Chemical; T. L. Bateman, Union Carbide Corporation; Thomas Rogstad, Union Carbide Corporation, and Stanley Schechter, Rohm & Haas.

The subcommittee wishes especially to acknowledge the many contributions of the principal author of this Guidelines text, Sanford Schreiber. Sandy is the CCPS staff member assigned to work with the Technical Management Subcommittee. He is substantially responsible not only for this book but for the direction and success of the entire CCPS Technical Management series as well. The subcommittee would also be remiss if the significant editorial contributions of Russell Till, of Till & Till, Inc., were not recognized.

Last, but surely not least, the CCPS Technical Management Subcommittee wishes to formally acknowledge and openly express its sincere thanks and appreciation to Thomas W. Carmody, Director of CCPS. Without the unswerving support, encouragement, and confidence he provided over the past five years, during development of this book and the two previous publications in this series, the subcommittee would not have been able to reach its goal. We would like to recognize Tom as personifying the attitude and characteristics of leadership that we believe are the quintessential elements of any successful manager. We are fortunate to have Tom, Sandy, and Tom’s entire staff stewarding the direction of the Center for Chemical Process Safety.

Appendix 9A, “Human Factors Considerations in Some of the Key Elements of Process Safety Management” was added to the book in the 1995 revision. This appendix was prepared by the CCPS Human Factors Reliability Subcommittee. The members of the subcommittee are Gary A. Page, American Cyanamid Co. (Chair); S. Barry Gibson, DuPont; Mark D. Johnson, Eastman Kodak Company; Joseph B. Mettalia, Jr., CCPS; Gary R. Van Sciver, Rohm and Haas Co.

Reviewers were David Embrey, Human Reliability Associates; Daniel A. Crowl, Michigan Technological University; Thomas O. Gibson, The Dow Chemical Co.; William N. Helmer, Hoechst Celanese Corp.; Robert W. Ormsby, Air Products and Chemicals, Inc.; John D. Snell, OxyChem; Don Turner, CH2M Hill; Lester Wittenberg, CCPS.
Equipment reliability: The probability that, when operating under stated environmental conditions, process equipment will perform its intended function for a specified exposure period.

Failure mode and effects analysis: A hazard identification technique in which all known failure modes of components or features of a system are considered in turn, and undesired outcomes are noted.

Fault tree: A method for representing the logical combinations of various system states that lead to a particular outcome (top event).

Fault tree analysis: Estimation of the hazardous incident (top event) frequency from a logic model of the failure mechanisms of a system.

Hazard: A chemical or physical condition that has the potential for causing damage to people, property, or the environment.

Hazard and Operability Study (HAZOP): A technique to identify process hazards and potential operating problems using a series of guide words to study process deviations.

Historical incident data: Data collected and recorded from past incidents.

Historical error: Actions by designers, operators, or managers that may contribute to or result in accidents.

Human factors: A discipline concerned with designing machines, operations, and work environments so that they match human capacities and limitations.

Human reliability: The study of human errors.

Incident: The loss of containment of material or energy.

Risk: A measure of economic loss or human injury in terms of both the incident likelihood and the magnitude of the loss of injury.
Risk analysis: The development of a qualitative or quantitative estimate of risk based on engineering evaluation and techniques for considering estimates of incident consequences and frequencies.

Risk assessment: The process by which the results of a risk analysis (i.e., risk estimates) are used to make decisions, either through relative ranking of risk reduction strategies or through comparison with risk targets.

Risk management: The systematic application of management policies, procedures, and practices to the tasks of analyzing, assessing, and controlling risk in order to protect employees, the general public, the environment, and company assets while avoiding business interruptions.