JAMES R. SAWERS
MARGARET M. R. EASTMAN

PROCESS INDUSTRY PROCEDURES AND TRAINING MANUAL

Process Industry Procedures and Training Manual

James R. Sawers, Ph.D., CMC
Margaret M. R. Eastman, CFJA

McGraw-Hill
New York San Francisco Washington, D.C. Auckland Bogotá
Caracas Lisbon London Madrid Mexico City Milan
Montreal New Delhi San Juan Singapore
Sydney Tokyo Toronto

Library of Congress Cataloging-in-Publication Data

Sawers, James R.
Process industry procedures and training manual / James R. Sawers. Margaret M. R. Eastman.
p. cm.
ISBN 0-07-054277-5
1. Industrial technicians—Job descriptions—Data processing. 2. Manufacturing processes—Safety measures—Documentation—Data processing. I. Eastman, Margaret M. R. II. Title.
TA158.S29 1996
660'.068'3—dc20 95-52569
CIP

McGraw-Hill

A Division of The McGraw-Hill Companies

1 2 3 4 5 6 7 8 9 0 DOC/DOC 9 0 0 9 8 7 6 5

ISBN 0-07-054277-5

The sponsoring editor for this book was Zoe Foundotos, the editing supervisor was Christine Furry, and the production supervisor was Suzanne W. B. Rapcavage. It was set in Century Schoolbook by North Market Street Graphics.

Printed and bound by R. R. Donnelley & Sons Company.

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please write to the Director of Special Sales, McGraw-Hill, 11 West 19th Street, New York, NY 10011. Or contact your local bookstore.

This book was printed on recycled, acid-free paper containing a minimum of 50% recycled de-inked fiber.

Other Reference Books of Interest by McGraw-Hill

Chemical Engineering Books

CHOPEY • *Fluid Movers*

CHOPEY • *Handbook of Chemical Engineering Calculations, Second Edition*

CONNELL • *Process Instrumentation Process Manual*

CONSIDINE • *Process/Industrial Instruments and Controls Handbook, Fourth Edition*

CROOM • *Filter Dust Collectors*

DATTA-BARUA • *Natural Gas Measurement and Control*

DEAN • *Lange's Handbook of Chemistry, Fourteenth Edition*

DESHOTELS, ZIMMERMAN • *Cost Effective Risk Assessment for Process Design*

DILLON • *Materials Selection for the Process Industries*

FITZGERALD • *Control Valves for the Chemical Process Industries*

HARPER • *Handbook of Plastics, Elastomers, and Composites, Third Edition*

KISTER • *Distillation Design*

KISTER • *Distillation Process Applications and Operations*

MANSFIELD • *Engineering Design for Process Facilities*

MCGEE • *Molecular Engineering*

MEYERS • *Petroleum Refining Processes, Second Edition*

MILLER • *Flow Measurement Engineering Handbook, Third Edition*

POWER • *Steam Jet Ejectors for the Process Industries*

REID, PRAUSNITZ, POLING • *The Properties of Gases and Liquids, Fifth Edition*

REIST • *Aerosol Science and Technology, Second Edition*

RHINE, TUCKER • *Modelling of Gas-Fired Furnaces & Boilers and Other Industrial Processes*

SATTERFIELD • *Heterogeneous Catalysis in Industrial Practice, Second Edition*

SCHWEITZER • *Handbook of Separation Techniques for Chemical Engineers, Second Edition*

SHINSKEY • *Feedback Controllers for the Process Industries*

SHINSKEY • *Process Control Systems, Fourth Edition*

SHUGAR, BALLINGER • *Chemical Technician's Ready Reference Handbook, Fourth Edition*

SHUGAR, DEAN • *The Chemist's Ready Reference Handbook*

SIKICH • *Emergency Management Planning Handbook*

SMALLWOOD • *Solvent Recovery Handbook*

SMITH • *Chemical Process Design*

TATTERSON • *Mixing and Gas Dispersion in Agitated Tanks*

TATTERSON • *Scale-up and Design of Industrial Mixing Processes*

YOKELL • *A Working Guide to Shell and Tube Heat Exchangers*

Preface

OSHA's First 1910.119 Investigation

On July 28, 1992, the Urea reactor at Arcadian Corporation's Lake Charles, Louisiana, plant failed catastrophically. There was no loss of life. Three employees were hospitalized and released within days. On July 29, OSHA padlocked the plant gates. On July 30, OSHA began interviewing every plant employee. Arcadian employees were not allowed in their own plant without an OSHA escort.

All employees including operators were interviewed individually for periods ranging from 2 to 6 hours, each by a group of 6 to 10 OSHA employees. Though their participation in these interviews was *voluntary,* OSHA would have subpoenaed them had they refused to cooperate. Employees were given the option of having a corporate attorney present. Since all operators had been laid off and were not being paid, some operators were bitter.

OSHA was interested in job documentation as well as operator knowledge and experience. They examined the qualifying tests for each job—operators, mechanics, laborers, and loaders. Operators were asked about their training, understanding, and use of SOPs, participation in Hazard and Operability Study (HAZOP) analyses, knowledge of detailed Process and Instrument Drawings (P&IDs), and other safety and operating details including OSHA-mandated training.

The plant was well-documented; indeed it was better documented than many, perhaps most, chemical plants. All SOPs and P&IDs had been updated only months before. Fulfillment, however, of any OSHA regulation that was not documented in writing was counted as though it had never occurred.

Financially, Arcadian suffered massive losses as a direct result of the closing of the Urea plant and an adjacent, unaffected ammonia plant. The OSHA assessment was a fine of $5.1 million (much larger figures were discussed). (This fine has since been reduced to less than $1 million

as a result of court action.) Individual citations totaled 144. More than 175 civil law suits have been filed. Losses will continue for many years.

I know, I was there.

Richard Bartely

Author's note: We have included this to emphasize how important job documentation is. This preface was written in July 1993. The ammonia plant, which survived the initial incident, was later sold and removed from the Lake Charles site. At another plant after a catastrophic incident in December 1994, one hundred eighty-six (186) different governmental agencies arrived on site requesting information. The first arrivals came in helicopters only hours after the explosion.

Acknowledgments

The authors wish to express appreciation to those who made this handbook possible. Sidney A. Fine, Ph.D., developer of Functional Job Analysis (FJA). Peg first came in contact with Sidney in the mid-1980s while being trained on Functional Job Analysis techniques. Regulatory requirements and corporate downsizing caused us to later modify our consulting offering. Sidney reviewed our modifications. We have met with him several times to discuss Functional Job Analysis and how it applies to our work. His insights have been incorporated into this handbook. We feel that they were helpful in validating changes in the original approach. We are happy to say that the approach which evolved has been well received by many large respected corporations both in the United States and abroad.

Warren Wilson of the DuPont Regional Incinerator at the Sabine River Works with whom we first discussed the idea of a formal training handbook to enable his Training Coordinator to update our original documents and to create new documents of similar appearance and content.

Christy Broussard for whom the first handbook was written.

We also wish to acknowledge the vision displayed by Joe Ray of Agricultural Minerals Corporation (now part of Ferra International) who introduced us to his corporate management and the AMC Training Managers, Clyde Knox and Doug Qualls. Their assistance and understanding of the 29 CFR 1910.119 requirements helped us immeasurably in expanding the scope of this work. We further appreciate AMC's introduction of Knowledge Technologies to other companies in the fertilizer industry.

We would like to thank Arcadian Fertilizer, LP, for the opportunity to work with their U.S. Process Safety Coordinators: Richard Bartley, Bill Belleu, Tom Brower, Frank Clark, Dennis DeMars, Bill Holder, Jimmy Lane, Don Skoff, Kevin Smiley, Roger Streed, Rick Voss, and Charlie Webb. We have worked with these men, plant management,

and corporate officials to define Arcadian's corporate standards. These standards covered OSHA-mandated training and basic skills training criteria. The enthusiasm and cooperation of their plant personnel has been extremely gratifying.

We are also pleased to be working with Arcadian Trinidad, Ltd., at Point Lisas, Trinidad and Tobago, West Indies. The PSM Project Team includes Eric Alleyene, Raymond Cook, Glen David, Glen Forde, Carl Francis, Andrew Goberdhan, Ingemar Goberdhan, Amarchandra Maharaj, Stanley Reid, Joseph Simon, Manohar Singh, Errol Wildman, and Thomas Young Hoo. They have customized training materials from the Arcadian U.S. Format. They have also developed customized Standard Operating Procedures, general purpose documents, and training materials.

We wish to acknowledge the assistance of Tommy Clyburn at Ampro Fertilizer, Inc.; Buddy Ball at Triad Chemical Company; and Steve Mistretta, Complex Safety Director for the Ampro-Triad facility, Donaldsonville, Louisiana. They have provided us with numerous examples which we have used in this handbook.

We have appreciated the opportunity to work with IMC-Agrico at its Faustina Plant in Saint James, Louisiana. Their Process Safety Superintendent, Dale Savoy, and their documentation staff, Larry LaBorde, Sigur Martin, Bobby Simoneaux, Wallace Turner, and Jimmy Vaughan have been a pleasure to know and work with. They have made valuable contributions to our documentation methodology.

We are happy to be working with CF Industries, Inc., in Donaldsonville, Louisiana and their Process Safety Coordinators Ray Ferrel, Jim Gwynn, Barry Morrison, Kevin Schaubhut, and Kevin Templet. Canadian Fertilizers, Ltd. (CF's affiliate in Canada), Process Safety Coordinators Fred Schmidt and Hubert Federkeil, have participated in the project both in the Donaldsonville documentation workshops and in a similar program in Medicine Hat, Alberta.

We feel privileged to have assisted the UNOCAL plant in Kenai, Alaska, with its PSM documentation for both the operations and maintenance organizations. Dave Haring has served as the PSM Group Leader and Edward Aisenbrey worked on the EDM installation. The Process Safety Coordinators included Ron Hansen, Rick Oelrich, Kelly Saltzgiver, Mark Schaafsma, Stephen Smith, Daryl Sutton, and Charlie Wilkins; they have all contributed to the success of the program. We would like to thank the Operations Group for their insights on improving the chain of evidence between validated tasks and the Training Plan. The maintenance chapter in this handbook contains numerous examples of documentation techniques developed at the Kenai plant. Both Operations and Maintenance Groups provided valuable contributions on improving the documentation efficiency for Skill Demonstra-

tions. A dedicated group of SMEs worked full time on the Operations job documentation; practically all Maintenance craftsmen contributed to the project on an as-needed basis.

We are pleased to have worked with Amoco Polymers Business Group in Marietta, Ohio on their job documentation. Bill Douthitt was responsible for overall coordination of their effort. In addition to Bill, Chuck Fortney, Bill Kerr, and Roger Sheppard were the PSCs charged with continuously upgrading and improving all aspects of Amoco's training program for operations and maintenance. Both in Operations and Maintenance, dedicated groups of Subject Matter Experts have worked full time on this project with excellent progress in all phases of job documentation.

And last but certainly not least, we express our deep appreciation to Sandy Reichenbach and Debby Guglielmetti who have patiently and cheerfully prepared revision after revision of this handbook, often under tight time schedules. They have also prepared the directions for using the templates used to create the job documents and various forms which accompany this handbook. And to Larry Zelner who has supported us in his prayers and counsel.

To the people who have participated in our workshops, we extend a special thanks for their comments on improvements that they felt would be helpful to the data-gathering process. Without exception, we have found every operator, craftsman, supervisor, and word processor with whom we have worked to be gracious, helpful, informative, and a real pleasure to get to know. They have participated far beyond the scope of our proposals both in data input and in interest. Nothing could have been achieved had they not been so cooperative. We have truly worked together for the greater good of all.

In closing, we would like to share a poem written by Ken Cissell, Unocal, Kenai, Alaska. He was part of a group of SMEs who worked full time on the PSM project as part of the documentation team.

Jim Sawers
Peg Eastman
Knowledge Technologies
16 Harleston Place
Charleston, South Carolina 29401
(803) 723-0400; fax (803) 723-0411
Internet: jimknowledgetech@msn.com

An SME's Lament

Ken Cissell
Unocal, Kenai, Alaska

There once was an SME
Who lived in a shoe;
Who wrote so many SOPs
That his face turned blue.
He huffed and he puffed
As he wrote it all down;
With his face in a scowl
And his pencil worn down.
The papers would fly
To his left and his right
As he slaved at his desk
Till late in the night.

He'd be there in the morning
Bright, cheerful, and ready to go;
But about two hours later
The strain would begin to show.
A 1,000 yard stare
Would slowly sink in;
His teeth would start clinching
And his lips would get thin.
With sweat on his forehead
And a twitch on his face
By quitting time in the evening,
His mind was in outer space.

So it went for days and weeks
And many years on end
Until finally it was over
The training plans were all in.
He had never thought
The day would come
When the end would be in sight.

Contents

Chapter

1

Job Documentation

Why Document Jobs?

Listed below are the primary reasons why people in plants, mills, and factories worldwide are documenting the jobs of their employees. They are:

- *OSHA Process Safety Management (PSM) compliance.* This is the most often cited reason both in the United States and, surprisingly, in Canada, Europe, and the Caribbean. Outside the United States, there is general recognition that national governments are moving toward some sort of regulation that will be modeled upon the OSHA regulation in the United States. To a greater or lesser extent, non-U.S. facilities of major companies based in the G-7 nations are under pressure from their parents to comply quickly with OSHA regulatory requirements regardless of the country in which the facility is located. Well-trained employees have fewer safety incidents.

  The sections of the PSM regulation in the handbook which will assist the reader prepare materials and programming include: Worker Participation, Process Safety Information, Operating Procedures, Training, Management of Change, Mechanical Integrity, Contractors, and Audits. This handbook does not cover all of these sections, only those portions related to job documentation.

- *EPA Risk Management Plan (RMP) compliance.* The final version of the RMP regulation has not yet been issued and is currently the subject of intense debate. The most controversial section of the proposed regulation is the Hazard Assessment section which defines the conditions for specifying the worst-case scenarios. These worst-case scenarios must be analyzed, impact on the surrounding community projected, and governmental agencies advised. This last provision, in