The information presented in this book was developed by occupational hygiene professionals with backgrounds, training, and experience in occupational and environmental health and safety, working with information and conditions existing at the time of publication. The American Industrial Hygiene Association (AIHA), as publisher, and the authors have been diligent in ensuring that the materials and methods addressed in this book reflect prevailing occupational health and safety and industrial hygiene practices. It is possible, however, that certain procedures discussed will require modification because of changing federal, state, and local regulations, or heretofore unknown developments in research. As the body of knowledge is expanded, improved solutions to workplace hazards will become available. Readers should consult a broad range of sources of information before developing workplace health and safety programs.

AIHA and the authors disclaim any liability, loss, or risk resulting directly or indirectly from the use of the practices and/or theories discussed in this book. Moreover, it is the reader’s responsibility to stay informed of the policies adopted specifically in the reader’s workplace and any changing federal, state, or local regulations that might affect the material contained herein.

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I am pleased that the American Industrial Hygiene Association (AIHA) has published this new, updated edition of *The Industrial Environment — its Evaluation and Control*, first published by NIOSH in 1973. Once again, this book will serve as a primary and comprehensive reference for occupational and environmental health students and professionals.

From the events of the past few years, we in the occupational safety and health community are challenged by having to respond to threats that were largely unanticipated, even unimaginable, 30 years ago when the first edition of this book appeared. We struggle to eliminate a host of traditional occupational safety and health hazards and to address new, elusive problems in today’s changing workplace, while tackling emerging hazards arising from terrorism, emergency response, and outbreaks of new diseases such as SARS, which may pose a job-related health risk in some occupational settings. By the same token, we are better able to meet these challenges thanks to the hard work that industrial hygienists and others have invested since the early 1970s, and the new tools, methodologies, and know-how that have come to us as dividends of that great investment. This new edition entitled *The Occupational Environment: Its Evaluation, Control, and Management* will assist industrial hygiene professionals to address today’s critical issues by including expanded information on air contaminants, indoor air quality, dermal exposure assessment, ionizing radiation, and laboratory health and safety controls.

NIOSH would like to acknowledge the contributions of the many experts and the work of the American Industrial Hygiene Association in developing this new edition. Their efforts will help to ensure emerging occupational and environmental health specialists achieve the highest level of skill and use innovative solutions to address old and new industrial hygiene problems.

John Howard, M.D.
Director, National Institute for Occupational Safety and Health
June 2003
I continue to be grateful to have the honor and pleasure to be the editor of this great project. Planning for the second edition began shortly after the publication of the first edition. Many of the users of the first edition provided insightful and constructively critical comments to AIHA headquarters staff. These comments were all considered seriously, and many were adopted to improve the second edition.

The first thing that you will notice is that the second edition is physically different from the first. This was in direct response to comments from end users about the ergonomic design of the book. The change from the original NIOSH title “The Industrial Environment: Its Evaluation and Control” to “The Occupational Environment: Its Evaluation and Control” reflected the evolution of the profession. This acknowledged that the industrial hygiene profession evolved to occupational hygiene. The title for this, the second edition, has been expanded to “The Occupational Environment: Its Evaluation, Control, and Management” to continue to track the changing nature of the occupational hygiene profession.

The attentive reader will also notice some changes in the list of chapters. Several chapters were expanded, eliminated, reassigned to different sections, or reordered within sections. All of these changes were in response to end users’ or peer reviewers’ comments.

In summary, this is your book; I am only the agent that enables you to have a current, updated reference to use and to consult.

Salvatore R. DiNardi, PhD, CIH
Professor and Chair
Environmental Health Sciences Department
School of Public Health and Health Services
University of Massachusetts, Amherst
The authors have once again done an outstanding job in writing and revising this textbook. Working together, the authors and AIHA staff have created an invaluable resource for the profession.

About two-thirds of the way through the production of this edition, the two key staffers acknowledged in the first edition as “the mother and ongoing force behind this book” and the second as “the glue that kept this project together,” left the Association. This was a personal and professional loss to me. The project was taken over by Barbara Taylor who has guided this project through to its publication. It was a formidable assignment to undertake, but she kept the project on schedule while continuing the outstanding level of work that was established in the first edition. Elizabeth Simon, the technical editor, performed a Herculean task to make this reference flow smoothly. She is the only person who has read every word in this book — twice! My hat goes off to her. Jim Myers, Katie Robert, and the AIHA Creative Services team have done a marvelous job of making this book “look good” and correcting its ergonomic problem. The unsung heroes in this project are the individual peer reviewers and technical committees acknowledged in the appendix.

I want to thank Stephen H. Gehlbach, dean of the University of Massachusetts, Amherst, for giving me the professional space to work on this project. Particular acknowledgement must also be given to my colleagues at the United States Naval Submarine Medical Research Laboratory, Submarine Atmosphere Health Assessment Program, namely, Captain Raymond Woolrich, Dr. David Slavin, and Mr. David Burnside, who provided an opportunity for me to apply my occupational hygiene skills to a real world situation and kept me on target. Finally, I will be forever grateful to Joan M. Culley, the love of my life, for her unwavering support that enabled me to complete this project.

Salvatore R. DiNardi, PhD, CIH
Professor and Chair
Environmental Health Sciences Department
School of Public Health and Health Sciences
University of Massachusetts, Amherst
July 2003

A special thank you to the late Jeffrey S. Lee, PhD, CIH, and Vernon E. Rose, Dr PH, CIH, whose vision and efforts resulted in this publication.
About the Editor

Salvatore Robert DiNardi, PhD, CIH
Professor and Chair
Environmental Health Sciences Department
School of Public Health and Health Sciences
University of Massachusetts, Amherst

In 1970, Dr. DiNardi started his academic career in Public Health at the University of Massachusetts in Amherst. He is Professor and Chair of the Environmental Health Science Department and Director of the Industrial Hygiene Program. He teaches Principles of Industrial Ventilation, Principles of Occupational Health, Human Exposure Assessment Modeling, Fundamentals of Indoor Air Quality, Industrial Hygiene Laboratory, and the Science of Terrorism Readiness. He is the principal scientific consultant for the United States Naval Submarine Medical Research Laboratory, (Groton, Connecticut) Submarine Atmospheric Health Assessment Program, US Navy trained to recognize and evaluate chemical, biological, radiological, nuclear, and environmental (CBRNE) agents.

Dr. DiNardi designs and implements indoor air quality surveys to recognize, evaluate, and control the sources of building related illness in the nonindustrial workplace. Dr. DiNardi has hands-on experience with indoor air quality problems especially epidemics of building related illness. He has completed indoor air quality surveys in more than ten million square feet of industrial/commercial spaces throughout the northeast. He provides solutions to these epidemics as well as training and advice on the subject for workers, supervisors, and managers in many Fortune 500 companies, smaller companies, and health care institutions.

Active in professional education, Dr. DiNardi also offers corporations, the United States government, and universities continuing education programs based on his university courses. He is a ventilation design or indoor air quality training consultant for many major corporations. He is also a continuing education consultant in ventilation design, exposure assessment modeling, basic industrial hygiene, and indoor air quality for the U.S. Navy and several universities.

Dr. DiNardi is certified in the comprehensive practice of industrial hygiene and is a Diplomate of the American Board of Industrial Hygiene. Dr. DiNardi holds a PhD in Physical Chemistry from the University of Massachusetts at Amherst.

Dr. DiNardi has published more than 40 articles in journals of environmental health, industrial hygiene, and chemistry. John Wiley publishes DiNardi’s book, Calculation Methods for Industrial Hygiene. He is the Editor of the American Industrial Hygiene Association’s best-selling reference The Occupational Environment — Its Evaluation and Control. He is co-author of A Glossary of Occupational Hygiene Terms, also published by the American Industrial Hygiene Association.

One of Dr. DiNardi’s goals is to find effective ways of protecting and enhancing the public health through the education of both practicing professionals and concerned citizens. He works closely with continuing education programs nationally to provide practical, current, and lively courses. He develops innovative ways of meeting the educational needs of people whose activities have a direct impact on the health of individuals, industries, communities, governments, and society. Alpha Sigma Lambda, the national continuing education honor society, acknowledged Dr. DiNardi’s service and commitment to continuing education by awarding him honorary membership. He is a member of Delta Omega Honorary Public Health Society, Rho Chapter. Since the publication of the first edition of The Occupational Environment, he has received several awards and certificates of appreciation from AIHA. In 2001, he received the American Industrial Hygiene Association’s Distinguished Service Award.
# Contents

- **Foreword** ..................................................... vi
  John Howard
- **Preface** ..................................................... vii
  Salvatore R. DiNardi
- **Acknowledgments** .......................................... ix
  Salvatore R. DiNardi
- **About the Editor** ........................................... xi

## Section 1. Introduction and Background

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>History and Philosophy of Industrial Hygiene</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Vernon E. Rose</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Environmental and Occupational Toxicology</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Michelle M. Schaper and Michael S. Bisesi</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Occupational Exposure Limits</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Dennis R. Klonne</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Legal Aspects of the Occupational Environment</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>W. Scott Railton</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Epidemiological Surveillance</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Harris Pastides and Kenneth A. Mundt</td>
<td></td>
</tr>
</tbody>
</table>

## Section 2. Hazard Recognition and Evaluation

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Comprehensive Exposure Assessment</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>John R. Mulhausen and Joseph Damiano</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Principles of Evaluating Worker Exposure</td>
<td>114</td>
</tr>
<tr>
<td></td>
<td>Sheryl A. Milz, Ronald G. Conrad, and Robert R. Soule</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Modeling Inhalation Exposure</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>Michael A. Jayjock</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Risk Assessment in the Workplace</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>Deborah Imel Nelson, Franklin E. Mirer, Gary M. Bratt, and David O. Anderson</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sampling of Gases and Vapors</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>Deborah F. Dietrich</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Analysis of Gases and Vapors</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>Patrick N. Breytse and Peter S.J. Lees</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sampling and Sizing of Airborne Particles</td>
<td>202</td>
</tr>
<tr>
<td></td>
<td>David L. Johnson and James H. Vincent</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Principles and Instrumentation for Calibrating Air Sampling Equipment</td>
<td>224</td>
</tr>
<tr>
<td></td>
<td>Peter F. Waldron</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Preparation of Known Concentrations of Gases, Vapors, and Aerosols</td>
<td>244</td>
</tr>
<tr>
<td></td>
<td>Bernard E. Saltzman</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Direct-Reading Instrumental Methods for Determining Concentrations of</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>Gases, Vapors, and Aerosols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lori A. Todd</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 16. Biological Monitoring .................................................................304
    Shane S. Que Hee
Chapter 17. Approaches for Occupational Dermal Exposure Assessment and Management ....328
    M. Cathy Fehrenbacher, Fred Arnold, Hans Marquardt, and Paul G. Evans
Chapter 18. Development of Occupational Skin Disease .....................................346
    Lutz W. Weber and J. Thomas Pierce
    Timothy J. Ryan
Chapter 20. Indoor Air Quality ......................................................................398
    Harriet A. Burge, Marion E. Hoyer, Ellen C. Gunderson, and Catherine C. Bobenhausen

Section 3. Physical Agents
Chapter 21. Noise, Vibration, and Ultrasound ..................................................434
    Robert D. Bruce, Arno S. Bommer, and Charles T. Moritz
Chapter 22. Nonionizing Radiation ................................................................494
    R. Timothy Hitchcock, C. Eugene Moss, William E. Murray, Robert M. Patterson, and
    R. James Rockwell, Jr.
Chapter 23. Ionizing Radiation ....................................................................572
    Margaret E. McCarthy and Bill Thomas
Chapter 24. Hot and Cold Environments .........................................................612
    Jerry D. Ramsey and Phillip A. Bishop
Chapter 25. Barometric Hazards ....................................................................646
    William Popendorf

Section 4. The Human Environment
Chapter 26. Work Physiology ......................................................................670
    Stephan A. Konz
Chapter 27. Biomechanics ...........................................................................684
    Joseph Hamill and Elizabeth C. Hardin
Chapter 28. Ergonomics ...............................................................................702
    James D. McGlothlin
Chapter 29. Psychology and Occupational Health ...........................................748
    E. Scott Geller
Chapter 30. Worker Education and Training ..................................................774
    Margaret C. Samways

Section 5. Controlling the Occupational Environment
Chapter 31. Prevention and Mitigation of Accidental Chemical Releases .............794
    Jeremiah R. Lynch
Chapter 32. General Methods for the Control of Airborne Hazards ....................828
    D. Jeff Burton
Chapter 33. An Introduction to the Design of Local Exhaust Ventilation Systems ....846
    Dennis K. George, Salvatore R. DiNardi, and Rodney G. Handy
Chapter 34. Evaluating Ventilation Systems ...................................................902
    A. David Scarchilli
Chapter 35. Personal Protective Clothing .......................................................912
    S. Zack Mansdorf and Norman W. Henry III
Chapter 36. Respiratory Protection .................................................................930
    Craig E. Colton and Thomas J. Nelson