

CONTRIBUTORS

In addition to the Technical Committees, the following individuals contributed significantly to this volume. The appropriate chapter numbers follow each contributor's name.

- Gregory J. Rosenquist** (1)
Lawrence Berkeley National Laboratory
- H. Michael Hughes** (1)
- James G. Crawford** (1)
Trane
- Van D. Baxter** (1)
Oak Ridge National Laboratory
- Lawrence Schoen** (2)
Schoen Engineering
- Paula Concannon** (2)
Munters DH
- Reinhold Kittler** (2)
Dectron
- E. Doug Fitts** (3, 5, 8)
St. Louis County Department of Public Works
- Itzhak H. Maor** (3, 5)
PWI Energy Inc.
- Joseph F. Scolaro** (3)
Scolaro Engineering Consultants
- Ralph Kittler** (4)
Dectron
- Richard Hermans** (6)
Center for Energy & Environment
- Douglas Erickson** (7)
- Jeffrey M. Hardin** (7)
U.S. Army Corps of Engineers
- Lynn F. Werman** (5, 6, 7)
HDR Architecture
- Gary Prusak** (9)
Bombardier Transportation
- James J. Bushnell** (9)
HVAC Consulting Services
- Kenneth R. Hesser** (9)
LTK Engineering Services
- Nicholas Zupp** (9)
Delphi Automotive
- Robert Cummings** (9)
Cummings Engineering Services
- Srini Natarajan** (9)
Lennox Industries
- Richard Johnson** (10)
The Boeing Company
- Christopher Spunar** (11)
Carrier Corporation
- Rich Evans** (12, 15, 17, 25, 26)
- Ravisankar Ganta** (12, 26)
Bechtel
- Mark Colino** (13)
Parsons Brinckerhoff Quade & Douglas Inc.
- Kelly Giblin** (13)
New Jersey Transit
- Steve Presser** (13)
ACME Engineering Products, Inc.
- Anthony York** (13)
Port Authority of New York/New Jersey
- Leonard Schwartz** (14)
- Louis Hartman** (14)
Harley Ellis
- Patrick Carpenter** (14)
TKLP
- Ivan Thomas** (16)
P2S Engineering, Inc.
- William Tschudi** (16)
Lawrence Berkeley National Laboratory
- Charles C. Shieh** (16, 17, 20, 24, 25)
CYS, LLC
- Mike Connor** (17, 19, 28)
Connor Engineering
- Norm Maxwell** (18)
Carrier Corporation
- John Riley** (20, 25, 26)
Black & Veatch
- Robert Baker** (21)
BBJ Environmental
- Cecily Grzywacz** (21)
The Getty Conservation Institute
- Albert J. Heber** (22)
Purdue University
- Farhad Memarzadeh** (22)
National Institutes of Health
- Gerald L. Riskowski** (22)
Texas A&M University
- Yuanhui Zhang** (22)
University of Illinois
- Roger C. Brook** (23)
Michigan State University
- Deep Ghosh** (25, 26)
Southern Company
- Thomas B. Axley** (25, 29, 30)
TVA
- Matt Hargan** (26)
Hargan Engineering
- John Marks** (27)
National Underground Science Laboratory
- Todd A. Talbott** (29, 30)
McGill Airflow Corporation
- Wayne M. Lawton** (29, 30)
ARCADIS
- Doug Horton** (31)
D J Horton & Associates
- Richard T. Swierczyna** (31)
Architectural Energy Corporation
- Stephen L. Brown** (31)
LC Systems
- Steven Kavanaugh** (32)
University of Alabama
- William Murphy** (32)
University of Kentucky
- Kevin Rafferty** (32)
Geo-Heat Center
- Mark Hertel** (33)
Sunearth, Inc.
- James Elleson** (34)
University of Wisconsin-Madison
- Richard Kooy** (34)
Chicago Bridge and Iron Company
- William Bahnfleth** (34)
The Pennsylvania State University
- Adam Hinge** (35)
Sustainable Energy Partnerships
- Andrew Rudin** (35)
- Cedric Trueman** (35)
Trueman Engineering Services
- Lawrence G. Spielvogel** (35)
Lawrence G. Spielvogel, Inc.
- Bill Thomaston** (36)
Alabama Gas Corporation
- Dennis H. Tuttle** (37)
- Frederick A. Lorch** (37)
Phoenix Controls Corporation
- Gaylon Richardson** (37)
Engineered Air Balance
- Gerald J. Kettler** (37)
Air Engineering & Testing, Inc.
- Mark Hegberg** (37)
ITT Bell & Gossett
- Ted N. Carnes** (37)
Pelton Marsh Kinsella
- William K. Thomas** (37)
Thomas Young Associates Inc.
- John Ryzewski** (38)
El Du Pont de Nemours and Company
- Richard Danks** (38)
NASA—Glenn Research Center
-

- Scott Sepsy** (38)
Princeton University
- David Branson** (39)
Compliance Services Group, Inc.
- Mark Hydeman** (39)
Taylor Engineering
- Mike Pouchak** (39)
Honeywell
- Kenneth Gillespie** (40)
PG&E
- Mark Ternes** (40)
Oak Ridge National Laboratory
- Michael MacDonald** (40)
Oak Ridge National Laboratory
- William R. Mixon** (40)
Tech Support Services
- Arthur Dexter** (41)
University of Oxford
- James E. Braun** (41)
Purdue University
- John Mitchell** (41)
University of Wisconsin-Madison
- Mark Cascia** (41)
Siemens Building Technologies
- Natascha Castro** (41)
NIST
- Andy Nolfo** (42)
The Murphy Company
- John Rieke** (42)
Karges-Faulconbridge, Inc. (KFI)
- Karl Stum** (42)
CH2M HILL
- Andre Desjarlais** (43)
Oak Ridge National Laboratory
- William B. Rose** (43)
University of Illinois
- Mike Ratcliff** (44)
RWDI
- David Wilson** (44)
University of Alberta
- John Carter** (44)
Cemak Peterka Petersen, Inc.
- Brian C. Krafthefer** (45)
Honeywell, Inc.
- Carolyn M. Kerr** (45)
InAir Environmental Ltd.
- Dean T. Tompkins** (45)
University of Wisconsin-Madison
- Derald G. Welles** (45)
Steril-Aire USA, Inc.
- Douglas W. Vanosdell** (45)
Research Triangle Institute
- Nick Agopian** (45)
Circul-Aire
- Paul R. Nelson** (45)
R.J. Reynolds Tobacco Co.
- Jim Winston** (46)
John Kettler (46)
- Monica Amalfitano** (46)
P2S Engineering, Inc.
- Steven Taylor** (46)
Taylor Engineering
- Eric Rosenberg** (47)
Kirkegaard Associates
- Jerry Lilly** (47)
JGL Acoustics
- John Paulauskis** (47)
HBE Corporation
- Rich Peppin** (47)
Scantek, Inc.
- Mark Hodgson** (48)
Clayton Group Services
- William R. Leizear, Sr.** (48)
Claude Laval Corporation
- Mark Leonardelli** (48)
Nalco Chemical
- Robert Petterson** (48)
Marley Cooling Tower Company
- Charles H. Sanderson** (48)
Superior Manufacturing Division
- Anne M. Wilson** (48)
Nalco Chemical
- Brad Windon** (49)
Rheem Manufacturing Company
- Daryl L. Hosler** (49)
Southern California Gas Company
- Rex Scare** (49)
Armstrong-Yoshitake
- Will Haag** (49)
A.O. Smith Water Products Company
- J.D. Spitler** (50)
Oklahoma State University
- Peter Donohue** (50)
Tyco Thermal Controls
- William Chapman** (50)
Birol I. Kilkis (50, 53)
Watts Radiant
- Leon E. Shapiro** (51)
ADA Systems
- John H. Klote** (52)
John H. Klote, Inc.
- Paul Meisel** (54)
Kinetics Noise Control
- Colleen S. Smith** (55)
Dais Analytic Corporation
- Lawrence Markel** (55)
Sentech Inc.
- Marvin Thedford** (55)

ASHRAE HANDBOOK COMMITTEE

Kenneth W. Cooper, Chair

2003 HVAC Applications Volume Subcommittee: **Kenneth W. Cooper**, Chair

Charles A. Francis **Douglas C. Hittle** **Henry Manczyk** **Michael A. Ratcliff** **Brian A. Rock** **Derald G. Welles**

ASHRAE HANDBOOK STAFF

Mark S. Owen, Editor

Heather E. Kennedy, Associate Editor

Nancy F. Thysell, Typographer/Page Designer

Barry Kurian, Manager and **Jayne E. Jackson**
Publishing Services

W. Stephen Comstock,
Director, Communications and Publications
Publisher
