

---

Sampling and Calibration for  
**ATMOSPHERIC  
MEASUREMENTS**

---

---

John K. Taylor, *editor*

---

---

---

---

---

---

---



STP 957

---

# SAMPLING AND CALIBRATION FOR ATMOSPHERIC MEASUREMENTS

A symposium sponsored by  
ASTM Committee D-22 on  
Sampling and Analysis  
of Atmospheres  
Boulder, CO, 12–16 Aug. 1985

ASTM SPECIAL TECHNICAL PUBLICATION 957  
John K. Taylor, National Bureau  
of Standards, editor

ASTM Publication Code Number (PCN)  
04-957000-17



1916 Race Street, Philadelphia, PA 19103

## Library of Congress Cataloging-in-Publication Data

Sampling and calibration for atmospheric measurements.

(ASTM special technical publication; 957)

“ASTM publication code number (PCN) 04-957000-17.”

Papers presented at the Conference on Sampling and Calibration for Atmospheric Measurements.

Includes bibliographies and index.

1. Air quality—Measurement—Congresses.
  2. Air—Pollution, Indoor—Measurement—Congresses.
- I. Taylor, John K. (John Keenan), 1912– . II. ASTM Committee D-22 on Sampling and Analysis of Atmospheres. III. Symposium on Sampling and Calibration for Atmospheric Measurements (1985: Boulder, Colo.) IV. Series.

TD890.S26 1987 628.5'3 87-12439

ISBN 0-8031-0955-5

Copyright © by AMERICAN SOCIETY FOR TESTING AND MATERIALS 1987  
Library of Congress Catalog Card Number: 87-12439

### NOTE

The Society is not responsible, as a body,  
for the statements and opinions  
advanced in this publication.

# Foreword

The symposium on Sampling and Calibration for Atmospheric Measurements was held in Boulder, Colorado, 12–16 August 1985. The symposium was sponsored by ASTM Committee D-22 on Sampling and Analysis of Atmospheres. John K. Taylor, National Bureau of Standards, Richard G. Melcher, Dow Chemical Company, and Harry L. Rook, National Bureau of Standards, presided as symposium chairmen. John K. Taylor is editor of this publication.

## **Related ASTM Publications**

**Quality Assurance for Environmental Measurements, STP 867 (1985),  
04-867000-16**

**Toxic Materials in the Atmosphere: Sampling and Analysis, STP 786 (1982)  
04-786000-17**

**Sampling and Analysis of Toxic Organics in the Atmosphere, STP 721  
(1981), 04-721000-19**

**Air Quality Meteorology and Atmospheric Ozone, STP 653 (1978), 04-  
653000-17**

**Calibration in Air Monitoring, STP 598 (1976), 04-598000-17**

## A Note of Appreciation to Reviewers

The quality of the papers that appear in this publication reflects not only the obvious efforts of the authors but also the unheralded, though essential, work of the reviewers. On behalf of ASTM we acknowledge with appreciation their dedication to high professional standards and their sacrifice of time and effort.

*ASTM Committee on Publications*

# **ASTM Editorial Staff**

**Helen M. Hoersch  
Janet R. Schroeder  
Kathleen A. Greene  
Bill Benzing**

# Contents

<b>Introduction</b>	1
GENERAL TOPICS	
<b>General Principles of Sampling</b> —BYRON KRATOCHVIL	5
<b>Principles of Calibration</b> —JOHN K. TAYLOR	14
INDOOR AIR—GENERAL	
<b>Overview of Indoor Air Quality Sampling and Analysis</b> — HAL LEVIN	21
<b>Indoor Air Quality Measurements</b> —ROY C. FORTMANN, NIREN L. NAGDA, AND MICHAEL D. KOONTZ	35
<b>Field Measurements for Air Quality in Office Buildings: A Three- Phased Approach to Diagnosing Building Performance Problems</b> —ELIA M. STERLING, EDWARD D. MCINTYRE, CHRISTOPHER W. COLLETT, JACK MEREDITH, AND THEODOR D. STERLING	46
<b>Sampling of Microbiological Contaminants in Indoor Air</b> — AHARON FRADKIN	66
AMBIENT AIR	
<b>Precision and Accuracy Assessment Derived from Calibration Data</b> —HARRY L. ROOK	81
<b>The EPA's Role in the Quality Assurance of Ambient Air Pollutant Measurements</b> —JOHN C. PUZAK AND FRANK F. MCELROY	87
<b>Parts-Per-Billion Gaseous Mixtures: A New Challenge</b> — ROBERT B. DENYSZYN AND TOM SASSAMAN	101
<b>Trace Gas Calibration Systems Using Permeation Devices</b> — GERALD D. MITCHELL	110

**Tunable Diode Laser Absorption Spectrometry for Ultra-Trace Measurement and Calibration of Atmospheric Constituents**—ALAN FRIED AND ROBERT SAMS 121

**Special Calibration Systems for Reactive Gases and Other Difficult Measurements**—W. D. DORKO AND E. E. HUGHES 132

WORKPLACE ATMOSPHERES

**Strategy for Industrial Hygiene Monitoring in the Chemical Industry**—SAM K. NORWOOD 141

**Laboratory and Field Validation of Solid Sorbent Samplers**—RICHARD G. MELCHER 149

**The U. S. Army's New Industrial Hygiene Sampling Guide**—FREDERIC BELKIN AND RICHARD W. BISHOP 166

**Detector Tubes**—ELMER S. MCKEE AND PAUL W. McCONNAUGHEY 176

**Recent Developments in the Sampling and Analysis of Isocyanates in Air**—VENKATRAM DHARMARAJAN, ROBERT D. LINGG, KARROL S. BOOTH, AND DAVID R. HACKATHORN 190

**Collection and Analysis of Airborne Hexamethylene Diisocyanate by a Modified OSHA Method**—GEORGE E. PODOLAK, RICHARD A. CASSIDY, GEORGE G. ESPOSITO, AND DONALD J. KIPPENBERGER 203

SUMMARY

**Summary** 215

**Author Index** 219

**Subject Index** 221

