American National Standard for Laboratory Ventilation

A Publication by American Industrial Hygiene Association
Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standard's developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he or she has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processors, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.
# Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>iii</td>
</tr>
<tr>
<td>1 Scope, Purpose, and Application</td>
<td>1</td>
</tr>
<tr>
<td>2 Laboratory Ventilation Management Program</td>
<td>2</td>
</tr>
<tr>
<td>3 Laboratory Chemical Hoods</td>
<td>7</td>
</tr>
<tr>
<td>4 Other Containment Devices.</td>
<td>21</td>
</tr>
<tr>
<td>5 Laboratory Ventilation System Design</td>
<td>28</td>
</tr>
<tr>
<td>6 Commissioning Tests</td>
<td>51</td>
</tr>
<tr>
<td>7 Work Practices</td>
<td>64</td>
</tr>
<tr>
<td>8 Preventive Maintenance</td>
<td>66</td>
</tr>
<tr>
<td>9 Air Cleaning</td>
<td>70</td>
</tr>
</tbody>
</table>

## Appendices

<table>
<thead>
<tr>
<th>Appendices</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX 1 Definitions, Terms, Units</td>
<td>75</td>
</tr>
<tr>
<td>APPENDIX 2 Referenced Standards and Publications</td>
<td>79</td>
</tr>
<tr>
<td>APPENDIX 3 Selecting Laboratory Stack Designs</td>
<td>81</td>
</tr>
<tr>
<td>APPENDIX 4 Audit Form for ANSI/IAHA Z9.5–2003</td>
<td>87</td>
</tr>
<tr>
<td>APPENDIX 5 Sample Table of Contents for Laboratory Ventilation Management Plan</td>
<td>111</td>
</tr>
</tbody>
</table>
Foreword (This foreword is not part of the American National Standard Z9.5–2003.)

General coverage. This standard describes required and recommended practices for the design and operation of laboratory ventilation systems used for control of exposure to airborne contaminants. It is intended for use by employers, architects, industrial hygienists, safety engineers, Chemical Hygiene Officers, Environmental Health and Safety Professionals, ventilation system designers, facilities engineers, maintenance personnel, and testing and balance personnel. It is compatible with the ACGIH Industrial Ventilation: A Manual of Recommended Practices, ASHRAE ventilation standards, and other recognized standards of good practice.

HOW TO READ THIS STANDARD. The standard is presented in a two-column format. The left column represents the requirements of the standard as expressed by the use of “shall.” The right column provides description and explanation of the requirements and suggested good practices or examples as expressed by the use of “should.” Appendices 1 and 2 provide supplementary information on definitions and references. Appendix 3 provides more detailed information on stack design. Appendix 4 provides a sample audit document and Appendix 5 presents a sample table of contents for a Laboratory Ventilation Management Plan.

Flexibility. Requirements should be considered minimum criteria and can be adapted to the needs of the User establishment. It is the intent of the standard to allow and encourage innovation provided the main objective of the standard, “control of exposure to airborne contaminants,” is met. Demonstrably equal or better approaches are acceptable. When standard provisions are in conflict, the more stringent applies.

Response and Update. Please contact the standards coordinator at AIHA, 2700 Prosperity Avenue, Suite 250, Fairfax, VA 22031, if you have questions, comments, or suggestions. As with all ANSI standards, this is a “work in progress.” Future versions of the standard will incorporate suggestions and recommendations submitted by its Users and others.

This standard was processed and approved for submittal to ANSI by the Z9 Accredited Standards Committee on Health and Safety Standards for Ventilation Systems. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard the Z9 Committee had the following members:

J. Lindsay Cook, Chair
Lou DiBerardinis, Vice-chair
Margaret Breida, Secretariat Representative
At the time of publication, the Secretariat Representative was Jill Snyder.

Organization Represented .................Name of Representative
Alliance of American Insurers ............F. K. Cichon
American Conference of Governmental
    Industrial Hygienists ....................R.T. Hughes
American Foundrymen’s Society ............R. Scholz
American Glovebox Society ...............S. Crooks
American Industrial Hygiene Association ....L. Blair
American Insurance Services Group ........M. T. Jones
American Society of Heating, Refrigerating,
    and Air Conditioning Engineers ........H. F. Behls
American Welding Society ................T. Pumphrey
Chicago Transit Authority ................E. L. Miller
National Spray Equipment
    Manufacturers Association .............D. R. Scarborough
US Department of Health and Human Services
   National Institute for Occupational Safety and Health . . .J. W. Sheehy
US Department of Labor
   Occupational Safety and Health Administration . . . . .I. Wainless
US Department of the Navy . . . . . . . . . . . . . . . . . . . . . . .G. Kramer

Individual Members
G. M. Adams
D. J. Burton
J. L. Cook
L. J. DiBerardinis
S. J. Gunsel
R. L. Karbowski
G. Knutson
M. Loan
K. Paulson
J. M. Price
J. C. Rock
M. Rollins
T. C. Smith
L. K. Turner

Subcommittee Z9.5 on Laboratory Ventilation, which developed this standard, had the following members:
Lou DiBerardinis, Chair
D. Jeff Burton
Douglas Walters,* Associate Chair (American Chemical Society) Steve Crooks (American Glovebox Society)
Gregory DeLuga*
Edgar Galson*
Daniel Ghidoni*
Todd Hardwick*
Ron Hill*
Dale Hitchings*
Gerhard Knutson
Victor Neuman*
John Price
Gordon Sharp*
Thomas Smith
J. Lindsay Cook (ex-officio)

* Contributing member of Z9.5 subcommittee but not a voting member of the full Z9 Committee at the time of standard approval.
1 Scope, Purpose, and Application

1.1 Scope

This standard sets forth the requirements for the design and operation of laboratory ventilation systems. This standard does not apply to the following types of laboratories or hoods except as it may relate to general laboratory ventilation:

- Explosives laboratories;
- Radioisotope laboratories;
- Laminar flow hoods (e.g., a clean bench for product protection, not employee protection);
- Biological safety cabinets.

1.2 Purpose

The purpose of this standard is to establish minimum requirements and best practices for laboratory ventilation systems to protect personnel from overexposure to harmful or potentially harmful airborne contaminants generated within the laboratory. It does not apply to comfort or energy considerations unless they have an effect on contaminant control ventilation.

This standard:

- Sets forth ventilation requirements that will, combined with appropriate work practices, achieve acceptable concentrations of air contaminants;
- Informs the designer of the requirements and conflicts among various criteria relative to laboratory ventilation;
- Informs the User of information needed by designers.

1.3 Application

There is a growing need for laboratories to conduct teaching, research, quality control, and related activities. Such laboratories should satisfy several general objectives, in addition to being suited for the intended use:

- They should be safe places to work;
- They should be in compliance with environmental, health, and safety regulations;
- They should meet any necessary criteria for the occupants and technology involved in terms of control of temperature, humidity, and air quality; and
- They should be as energy efficient as is practical while adhering to above objectives.

This standard addresses the ventilation requirements to satisfy the first criterion: making the laboratory a safe place to work. When techniques and designs are available to reconcile conflicts between safety criteria and other, possibly conflicting demands, they are discussed. General laboratory safety practices are not included except when they may relate to the ventilation system’s proper function or effectiveness.

Traditional ventilation system designs typically do not meet all of the foregoing criteria, and most importantly they very often do not ensure adequate safety for the laboratory occupants. Persons responsible for laboratory operations and those working within a laboratory are typically not very knowledgeable about how ventilation systems directly impact laboratory occupant health and safety. Thus, they may not be aware of inadequate ventilation or other ventilation system deficiencies. On the other hand, ventilation system design professionals cannot be expected to be fully aware of all the particular hazards posed by every type of operation that may occur in a laboratory room. Furthermore, the specific work and operations of some laboratory facilities may need to be kept more confidential and may even be highly secretive.