Ventilation and Control of Airborne Contaminants During Open-Surface Tank Operations
American National Standard —
Ventilation and Control of Airborne Contaminants During Open-Surface Tank Operations

Secretariat

American Industrial Hygiene Association

Approved: August 18, 2006

American National Standards Institute, Inc
Approval of an American National Standard requires verification by ANSI that the requirement 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 objection 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CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time.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>Topic</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 Referenced Standards and Publications</td>
<td>2</td>
</tr>
<tr>
<td>3 Definitions</td>
<td>3</td>
</tr>
<tr>
<td>4 Classification of Open-Surface Tank Operations</td>
<td>6</td>
</tr>
<tr>
<td>5 Emission and Exposure Control Requirements</td>
<td>9</td>
</tr>
<tr>
<td>6 Push-Pull Ventilation</td>
<td>26</td>
</tr>
<tr>
<td>7 General Exhaust Ventilation</td>
<td>27</td>
</tr>
<tr>
<td>8 Vapor Degreasing Tanks</td>
<td>27</td>
</tr>
<tr>
<td>9 Special Precautions for Cyanide</td>
<td>28</td>
</tr>
<tr>
<td>10 Operation and Maintenance</td>
<td>29</td>
</tr>
<tr>
<td>11 Respirators</td>
<td>30</td>
</tr>
</tbody>
</table>

## Appendices

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Chemical Data Tables</td>
<td>33</td>
</tr>
<tr>
<td>B Audit Form</td>
<td>37</td>
</tr>
<tr>
<td>C References</td>
<td>41</td>
</tr>
</tbody>
</table>
FOREWORD (This foreward is not part of the American National Standard/AIHA Z9.1-2006)

This standard was developed from extended and careful examination of successful current practice in the control of health hazards resulting from open-surface tank operations. The requirements set forth are considered the minimum necessary to ensure the safety of the workers involved. Appendix A contains information on the properties of potentially toxic contaminants.


How to read this Standard: The Standard is presented in a two-column format. The left column presents the requirements of the Standard; the right column provides clarification and explanation of the requirements plus “how to comply” information.

This standard also contains Appendices, which are informative and are not considered a mandatory part of this standard.

Flexibility: Requirements are minimum criteria and can be adapted to the needs of the user. Demonstrably equal or better approaches are acceptable. Where standard provisions are in conflict with other standards and codes, the more stringent should be applied. Where the user deviates from Standards requirements, the user should document justification for the deviation.

Auditing: The Standard is auditable. An Audit Form is provided in Appendix B.

Response and Update: Please contact the American Industrial Hygiene Association if you have questions, comments, or suggestions. As with all ANSI standards, this is a “work in progress.” New technology and research continues to change this field and it is hoped that future versions of the standard will reflect this growth in knowledge. Suggestions for improvement are welcome, and should be sent to the American Industrial Hygiene Association (Attn: Scientific and Technical Initiatives), 2700 Prosperity Avenue, Suite 250, Fairfax, VA 22031 http://www.aiha.org.

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
L. DiBerardinis, Vice Chair
Mili Mavely, Secretariat Representative

<table>
<thead>
<tr>
<th>Organization Represented</th>
<th>Name of Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alliance of American Insurers</td>
<td>S. Ecoff</td>
</tr>
<tr>
<td>American Chemical Society</td>
<td>D. Walters</td>
</tr>
<tr>
<td>American Conference of Governmental Industrial Hygienists</td>
<td>G. Knutson</td>
</tr>
<tr>
<td>American Automobile Manufacturers Association</td>
<td>G. M. Adams</td>
</tr>
<tr>
<td>American Foundrymen's Society</td>
<td>R. Scholz</td>
</tr>
<tr>
<td>American Glovebox Society</td>
<td>S. Crooks</td>
</tr>
<tr>
<td>American Society of Heating, Refrigerating, and Air Conditioning Engineers</td>
<td>H. F. Behls</td>
</tr>
<tr>
<td>Chemical Industry Institute of Toxicology</td>
<td>J. L. Cook</td>
</tr>
<tr>
<td>Massachusetts Institute of Technology</td>
<td>L. J. DiBerardinis</td>
</tr>
</tbody>
</table>
ANSI/AIHA Z9.1–2006

National Association of Metal Finishers
National Spray Equipment Manufacturers Association
National Institute of Occupational Safety and Health
U. S. Department of Labor Occupational Safety and Health Administration

Individual Members
D. Blackburn
D. J. Burton
C. Figueroa
S. J. Gunsel
R. L. Karbowski
N. McManus
D. O’Brien
K. Paulson
J. M. Price
J. C. Rock
M. Rollins
D. R. Scarbrough
T. C. Smith
L. K. Turner

The Z9.1 subcommittee on Ventilation and Control of Airborne Contaminants During Open-Surface Tank Operations, which developed this standard, had the following members:

J. W. Sheehy, Chair
G. Adams
D. J. Burton
K. C. Hankinson
G. Knutson
K. Paulson
1. **Scope, Purpose and Application**

1.1 **Scope**

This standard establishes minimum control requirements and ventilation system design criteria for controlling and removing air contaminants to protect the health of personnel engaged in open-surface tank operations. It is not intended to cover fire protection.

1.2 **Objectives**

The objectives of this standard are to:

- Protect the health and well-being of open-surface tank workers by establishing minimum requirements to control emissions of gases, vapors, or mists from open-surface tank operations.
- Prevent explosive concentration of gases or vapors in ducts, hoods, and enclosures.
- Protect workers from splashes and other contact with liquids.
- Prevent objectionable increases in humidity.
- Advise establishments to conform to local or state air pollution regulations.

Because of the wide variation between operations, locations, work practices, construction, equipment age, and so forth, compliance with this standard cannot guarantee that the objectives of Paragraph 1.2 will be met at all times and at all locations.

1.3 **Application**

This standard applies to those establishments that have open surface tanks involved in the immersion of parts in liquids or vapors for the purpose of cleaning, altering the surface, adding a finish, or changing the character of the materials. These operations include but are not limited to wet processes such as: washing, electroplating, anodizing, pickling, quenching, dyeing, dipping, tanning, dressing, bleaching, degreasing, alkaline cleaning, stripping, rinsing, digesting, and other similar operations.

1.4 **Exclusions**

This standard does not apply to:

1. Molten materials handling operations;
2. Surface coating operations, excluding open-tank operations; and
3. Wet-sink operations in semiconductor manufacturing operations that are designed and operated to comply with SEMI ventilation standards.

(1) Molten materials handling operations are all operations involving the use, melting, smelting, or pouring of metals, alloys, or other similar substances in the molten state. This includes heat-treating baths, descaling baths, die casting, stereotyping, galvanizing, and tin-
ning operations.

(2) Surface-coating operations refers to operations involving the application of protective, decorative, adhesive, or strengthening coating or impregnation to one or more surfaces or into the interstices of any object or material by means of spraying, spreading, flowing, brushing, roll-coating, pouring, and cementing, e.g. paint-dripping operations.

(3) Wet-sink (wet-station) operations normally occur in special clean-