The IAQ Investigator’s Guide, 3rd edition

Book
Regular Pricing:
Member $60
Non-Member $90
Student $60

PDF
Regular Pricing:
Member $60
Non-Member $90
Student $60

KIT
Regular Pricing:
Member $90
Non-Member $135
Student $90

JOIN NOW AND SAVE!
AIHA members receive discounts and free shipping on all Bookstore orders.

ORDER the BOOK
ORDER the PDF
ORDER the KIT
## Contents

### Chapter 1: Introduction

- **Introduction** ..................................................................................................... 1

### Chapter 2: Background

- **Health Effects Related to IAQ** ........................................................................... 4
- **Buildings and the Building Environment** ............................................................. 7
- **Ventilation** .......................................................................................................... 7
- **Thermal Comfort and Relative Humidity (RH)** ...................................................... 8
- **Building Dampness and Mold** ............................................................................... 9
- **Odors and Air Contaminants** .............................................................................. 10
- **Lighting, Noise and Other Physical Factors** ........................................................ 10
- **Trends in Building Design, Materials and Furnishings** ....................................... 11
- **IAQ Investigation Strategies** ................................................................................ 12

### Chapter 3: Initial Investigation

- **Determine if this is an Emergency** ...................................................................... 18
- **Steps in Investigation (Non-Emergency)** ............................................................. 20
- **Historical Information Review** ........................................................................... 20
- **Initial Walk-through Survey** ................................................................................ 23
  - **Particulates** ........................................................................................................ 23
  - **Air Contaminants** ............................................................................................. 24
  - **Water Intrusion and Mold** ................................................................................ 25
  - **Other Indoor Environmental Issues** .................................................................. 28
  - **Preliminary Measurements** .............................................................................. 28
  - **Smoking and Vaping** ......................................................................................... 33
- **Findings and Recommended Corrective Actions** .................................................. 34

### Chapter 4: HVAC Overview and Inspection

- **HVAC Overview** .................................................................................................. 37
  - **Terminology** ...................................................................................................... 39
  - **HVAC System Basics and Types** ...................................................................... 41
- **HVAC Inspection** ................................................................................................ 46
  - **Outdoor Air** ...................................................................................................... 46
  - **Filters** .............................................................................................................. 48
  - **Heating and Cooling Coils** ............................................................................... 49
  - **Humidifiers** ..................................................................................................... 50
  - **Supply Ductwork** ............................................................................................ 51
  - **Terminal Units** ................................................................................................. 52
  - **Return Air** ....................................................................................................... 52
  - **Exhaust Air** ..................................................................................................... 53
  - **Mechanical Rooms** ......................................................................................... 54
Chapter 1: Introduction

What makes a good IAQ investigator?

The attributes of a prepared, informed detective: calm, observant, thorough, and discerning. Additional attributes include skill in knowing which questions to ask, knowledge about building systems, how buildings are run, evidence-based health risks, potential sources of indoor air contaminants, how to put together a strategy to diagnose a problem, and how to connect the dots between personal accounts, investigator observations, and test results. Willingness to engage promptly and the ability to communicate truthfully, clearly and without undue speculation with respect to all parties are also invaluable assets.

In this context, the American Industrial Hygiene Association’s Indoor Environmental Quality Committee offers this practical guide. It is intended as a roadmap so that others may profit from lessons learned, and become educated in techniques and strategies for resolving IAQ issues quickly and cost-effectively.

The indoor environment has emerged as an area of specialty for industrial hygienists. Building owners, property managers,
employers, mechanical engineers, architects, and medical professionals have also been called on to resolve IAQ complaints. Regardless of expertise or background, it is helpful for the IAQ investigator to:

• Understand all that is involved in identifying the root cause(s) of the initial complaints, or, in some cases, resolving the situation without absolute certainty about the cause(s), and
• Be willing to enlist the help of professionals with expertise in diverse specialties, as the need arises.

The focus of this guide is office environments. However, many of the principles apply to other building types including schools, laboratories, health care facilities, and to some extent, residences.

This newest, 3rd edition represents a major update to incorporate current information and has new material on:

• Risk communication and report writing;
• Trend setting drivers such as green building certifications and low- and zero-energy initiatives;
• Lighting and noise;
• Layout of typical heating, ventilating and air conditioning (HVAC) systems;
• Radon assessment, and
• Guidelines for interpreting volatile organic compound (VOC) data.

Other topics are introduced in sidebars and breakout boxes, including: polychlorinated biphenyls (PCBs), corrosive drywall, spray polyurethane foam (SPF) insulation, and semi-volatile organic compounds (SVOCs). Asbestos and lead issues are not covered; the reader should refer to appropriate regulatory requirements and current technical guidance on those issues.

The contributing authors share case studies from what they’ve experienced. These can be found in sidebars depicted by a magnifying glass.

This guide should not be followed unthinkingly, like a “cookbook” nor should it be viewed as providing an encyclopedic treatment of the field. It does not eliminate the need for an IAQ investigator to pursue continuous professional development. The authors aspire for it to serve as a solid foundation for life-long learning in this continuously evolving area of practice.
Given the fact that performing IAQ investigations involves assessment of environmental health stressors in the built environment and their potential risks to occupants, elements of risk communication will almost certainly be involved in the process if risks are identified in the assessment process. Therefore it is imperative that not only must IAQ practitioners be grounded in risk assessment and risk management principles but they must also be able to effectively communicate risk if they are to be considered competent professionals. The importance of being able to effectively and honestly communicate and discuss risk cannot be overstated. Diverse groups may be considered “interested parties” that are vested in the results of a given IAQ investigation. These parties may include building occupants or their representatives, parents or relatives of occupants, building owners or managers, insurers, allied investigators or medical personnel, regulators, the public and in some cases, the media.

Building investigations may involve responding to “IAQ emergencies” where occupants either evacuate a “problem” facility or refuse to enter a building until and unless the causes of their health issues are discovered and addressed. Poor or lack of response on the part of building owners/managers to occupant concerns may elicit
feelings of distrust, disrespect or disgusted in occupants, parents or the media. A skillful risk communicator has the ability to reduce tensions, relieve anxiety and effect appropriate changes in not only how a building is operated and maintained but also in forming an effective program of conflict resolution and a proactive, on-going program of complaint response and decision-making involving all concerned parties. The practices given in this chapter can apply to very large serious IAQ problems, such as a *Legionella* outbreak affecting a whole building; but they can also apply and be useful in responding to and resolving smaller less serious problems.

According to the EPA report, *Effective Risk and Crisis Communication during Water Security Emergencies, Summary Report of EPA Sponsored Message Mapping Workshops* (109), “Risk communication is a science-based approach for communicating effectively and accurately to diverse audiences in situations that are high-concern, high-stress, emotionally charged, and/or highly controversial. Its purpose is to enhance knowledge and understanding, build trust and credibility, encourage constructive dialogue, produce appropriate levels of concern, and provide guidance on appropriate protective behavior and actions following a crisis incident. Although much about risk communication involves elements of common sense, its principles are supported by a considerable body of scientific research as reflected in more than 8,000 articles in peer-reviewed scientific journals, 2,000 published books, and a number of published literature reviews by major scientific organizations such as the National Academy of Sciences.”

“As with many other activities, good risk communication requires anticipation, preparation, and practice. This involves anticipating scenarios requiring risk communication, preparing key messages, and practicing delivery in advance of crisis events. Preparing for effective risk communication is an ongoing process that should be an integral component of overall crisis response planning.”
Seven General Rules of Risk Communication\textsuperscript{(109)}

The following are examples of best practices for effective risk communications:

1. Accept and involve stakeholders as legitimate partners
   - Demonstrate respect for those affected by risk management decisions by involving people early, before important decisions are made.
   - Include in the decision-making process the broad range of factors involved in determining perceptions of risk, concern, and outrage.
   - Involve all parties that have an interest or a stake in the risk in question.
   - Use a wide range of communication channels to engage and involve people.
   - Adhere to highest ethical standards: recognize that people hold you professionally and ethically accountable.
   - Strive for win-win outcomes.

2. Listen to people
   - Do not make assumptions about what people know, think or want done about risks.
   - Take the time before taking action to find out what people are thinking: use techniques such as interviews, facilitated discussion groups, information exchanges, availability sessions, advisory groups, toll-free numbers, and surveys.
   - Let all parties who have an interest or a stake in the issue be heard.
   - Let people know that what they said has been understood and what actions will follow.
   - Identify with your audience and try empathetically to put yourself in their place.
   - Acknowledge the validity of people’s emotions.
   - Emphasize communication channels that encourage listening, feedback, participation, and dialogue.
   - Recognize that competing agendas, symbolic
meanings, and broader social, cultural, economic, or political considerations often exist and complicate the task of risk communication.

3. **Be truthful, honest, frank, and open**
   - If an answer is unknown or uncertain, express willingness to respond to the questioner within an agreed-upon deadline.
   - Disclose risk information as soon as possible (emphasizing appropriate reservations about reliability); fill information vacuums.
   - Do not minimize or exaggerate the level of risk; do not over reassure.
   - Make corrections quickly if errors are made.
   - If in doubt, lean toward sharing more information, not less – or people may think something significant is being hidden or withheld.
   - Discuss data and information uncertainties, strengths and weaknesses – including the ones identified by other credible sources.
   - Identify worst-case estimates as such, and cite ranges of risk estimates when appropriate.
   - Do not speculate, especially about worst cases.

4. **Coordinate, collaborate, and partner with other credible sources**
   - Take the time to coordinate all inter-organizational and intra-organizational communications.
   - Devote effort and resources to the slow, hard work of building bridges, partnerships, and alliances with other organizations.
   - Use credible and authoritative intermediaries between you and your target audience.
   - Consult with others to determine who is best able to take the lead in responding to questions or concerns about risks: establish and document agreements.
   - Do not attack those with higher perceived credibility.
   - Cite credible sources, issue communications together with, or through, other trustworthy sources.
5. **Meet the needs of the media (if relevant; this is uncommon)**
   - Be accessible to reporters; respect their deadlines.
   - Prepare a limited number of key messages in advance of media interactions; take control of the interview and repeat or bridge to your key messages several times.
   - Provide information tailored to the needs of each type of media, such as sound bites and visuals for television.
   - Provide background materials on complex risk issues.
   - Say only those things that you are willing to have repeated by the media: everything you say is on the record.
   - Keep interviews short: agree with the reporter in advance about the specific topic of the interview and stick to this topic during the interview.
   - Always tell the truth.
   - If you do not know the answer to a question, focus on what you do know and tell the reporter what actions you will take to get an answer.
   - Stay on message; bridge to important messages.
   - Be aware of, and respond effectively to media pitfalls and trap questions.
   - Avoid saying “no comment.”
   - Follow up on stories with praise or criticism, as warranted.
   - Work to establish long-term relationships of trust with specific editors and reporters.

6. **Speak clearly and with compassion**
   - Use clear, non-technical language appropriate to the target audience.
   - Use graphics and other pictorial material to clarify messages.
   - Avoid embarrassing people.
   - Respect the unique communication needs of special and diverse audiences.
• Understand that trust is earned – do not ask or expect to be trusted by the public.
• Express genuine empathy; acknowledge, and say, that any illness, injury, or death is a tragedy and to be avoided.
• Personalize risk data: use stories, narratives, examples, and anecdotes that make technical data come alive.
• Avoid distant, abstract, unfeeling language about harm, deaths, injuries, and illnesses.
• Acknowledge and respond (in words, gestures, and actions) to emotions that people express, such as anxiety, fear, anger, outrage, and helplessness.
• Acknowledge and respond to the distinctions that the public views as important in evaluating risks.
• Use risk comparisons to help put risks in perspective; avoid comparisons that ignore distinctions people consider important.
• Identify specific actions that people can take to protect themselves and to maintain control of the situation at hand.
• Be sensitive to local norms, such as speech and dress.
• Strive for brevity, but respect a person’s desire for information and offer to provide needed information within a specified period of time.
• Always try to include a discussion of actions that are underway or can be taken.
• Promise only that which can be delivered, then follow through.

7. **Plan thoroughly and carefully**
• Begin with clear, explicit objectives – such as providing information, establishing trust, encouraging appropriate actions, stimulating emergency response, or involving stakeholders in dialogue, partnerships, and joint problem solving.
• Identify important stakeholders and subgroups within the audience – respect diversity and design communications for specific stakeholders.
• Recruit spokespersons with effective presentation and personal interaction skills.
• Train staff – including technical staff – in basic, intermediate, and advanced risk and crisis communication skills: recognize and reward outstanding performance.
• Anticipate questions and issues.
• Prepare and pretest messages.
• Carefully evaluate risk communication efforts and learn from mistakes.
• Share what you have learned with others.
# Appendix B: Common IAQ Problems and Possible Causes

<table>
<thead>
<tr>
<th>Complaint</th>
<th>Symptoms Might Include</th>
<th>Possible Causes</th>
<th>Predisposing Factors</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sick Building Syndrome</td>
<td>Headaches, irritation, congestion, fatigue</td>
<td>Not clearly known, likely associated with combinations of factors. Not known to be related to the presence of specific chemicals or biological agents.</td>
<td>Worse when and where outdoor air ventilation is inadequate; elevated temperature and dust identified as risk factors</td>
<td>Common (a small number of cases may occur in well-maintained buildings)</td>
</tr>
<tr>
<td>Allergic Reactions</td>
<td>Swelling, itching, congestion, excess mucus, breathing complaints or asthma</td>
<td>Unsanitary conditions (excessive dust or mold growth); presence of common human allergens (e.g. cat allergen and others)</td>
<td>Individuals with identified allergies at higher risk of these complaints usually have history of allergies (about 10–20% of population)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Hypersensitivity Illness</td>
<td>Cough, shortness of breath, fever, chills, fatigue, symptoms often pronounced in some individuals</td>
<td>Repeated exposure to microbial aerosols</td>
<td>Initially sensitized to high level exposures to certain types of microbial contamination</td>
<td>Rare</td>
</tr>
<tr>
<td>Complaint</td>
<td>Symptoms Might Include</td>
<td>Possible Causes</td>
<td>Predisposing Factors</td>
<td>Prevalence</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Irritation</td>
<td>Watering, burning or dryness of eyes, difficulty in wearing contact lenses, hoarse voice, nose, or throat irritation, may be accompanied by other nonspecific symptoms such as headache, nausea, or fatigue</td>
<td>Excessive concentrations of volatile chemicals such as solvents or formaldehyde; might also be because of low humidity</td>
<td>Some people are more sensitive; tends to be worse during peak emissions or episodes of low humidity (e.g., winter months)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Carbon Monoxide Poisoning</td>
<td>Headache, dizziness, nausea, loss of consciousness, coma, death</td>
<td>Combustion gases</td>
<td>Cardiac and respiratory disease in more sensitive individuals</td>
<td>Rare</td>
</tr>
<tr>
<td>Neurological</td>
<td>Headaches, tremors, loss of memory</td>
<td>Insecticide misuse</td>
<td>Some individuals are more sensitive</td>
<td>Rare</td>
</tr>
<tr>
<td>Respiratory Infections</td>
<td>Diagnosed infection such as legionellosis or aspergillosis</td>
<td>Should be related to specific contaminant in building</td>
<td>Immune system deficiencies</td>
<td>Rare</td>
</tr>
<tr>
<td>Comfort (thermal)</td>
<td>Too hot, too cold, too stuffy, too drafty</td>
<td>HVAC</td>
<td>Difficulty in obtaining thermal satisfaction of all occupants, often straight-forward to diagnose</td>
<td>Common</td>
</tr>
<tr>
<td>Comfort (nuisance)</td>
<td>No symptoms, just concern for unusual odor, unusual quantities of settled dust, dust stains near supply air diffusers, or other conditions</td>
<td>Inadequate control of source emissions or contamination, poor housekeeping</td>
<td>Stressful work or personal conditions may trigger or exacerbate such complaints</td>
<td>Moderate</td>
</tr>
<tr>
<td>Psychosocial Stressors</td>
<td>Headaches, fatigue, muscle aches</td>
<td>Stressful work conditions, poor labor relations, overcrowding, thermal discomfort, malodor, unrelated concerns</td>
<td>Poor communication, internal and external stressors, workforce having many personal issues</td>
<td>Common</td>
</tr>
<tr>
<td>Mass Psychogenic Illness</td>
<td>Hyperventilation, fainting, vomiting, dizziness, skin irritation</td>
<td>Symptoms spread by visual and verbal cues</td>
<td>Visual and verbal contact between affected individuals</td>
<td>Rare</td>
</tr>
<tr>
<td>Ergonomic Problems</td>
<td>Muscle aches, fatigue, eyestrain, headaches</td>
<td>Uncomfortable seating, repetitive motion</td>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td>Lighting</td>
<td>Eyestrain, headaches</td>
<td>Detailed visual tasks</td>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td>Noise</td>
<td>Headaches, fatigue</td>
<td>Excessive noise from HVAC system, office equipment, poor acoustics</td>
<td>Area design, loud occupants, insulation needs</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cluster of Adverse Health Effects</td>
<td>Headaches, respiratory symptoms, fatigue</td>
<td>May be communicable infectious diseases or illnesses (flu, common cold, etc.)</td>
<td></td>
<td>Moderate</td>
</tr>
</tbody>
</table>
Appendix C:

**EPA Guidelines for IAQ Problem Causes and Solutions**

(Adapted from EPA I-BEAM software. Available at http://www.epa.gov/iaq)

**Indoor Sources**

The following table identifies sources of contaminants commonly found in office buildings and offers some measures for maintaining control of these contaminants. Follow these measures to help maintain a healthy indoor environment.
<table>
<thead>
<tr>
<th>Category/Common Sources</th>
<th>Tips for Mitigation and Control</th>
</tr>
</thead>
</table>
| **Housekeeping and Maintenance**                            | • Use low-emitting products  
• Avoid aerosols and sprays  
• Dilute to proper strength (manufacturer’s instructions)  
• Do not overuse; use during unoccupied hours  
• Use proper protocol when diluting and mixing  
• Store properly with containers closed and lid tight  
• Use exhaust ventilation for storage spaces (eliminate return air)  
• Clean mops: store mop top up to dry  
• Avoid “air fresheners”—clean and exhaust instead  
• Use high efficiency vacuum bags/filters  
• Use Integrated Pest Management                                                                                                                                                     |
| **Occupant-Related Sources**                                | • Smoking policy  
• Use exhaust ventilation with pressure control for major local sources  
• Low emitting art supplies/marking pens  
• Avoid paper clutter  
• Education material for occupants and staff                                                                                                                                          |
| **Building Uses as Major Sources**                          | • Use exhaust ventilation and pressure control  
• Use exhaust hoods where appropriate; check hood airflows                                                                                                                                                                |
| **Building-Related Sources**                                | • Use low emitting products  
• Air out in an open/ventilated area before installing  
• Increase ventilation rates during and after installing  
• Keep material dry prior to enclosing  
• Use renovation guidelines                                                                                                                                                        |
<table>
<thead>
<tr>
<th>Category/Common Sources</th>
<th>Tips for Mitigation and Control</th>
</tr>
</thead>
</table>
| **HVAC system**         | • Perform HVAC preventive maintenance  
                          | • Use filter change protocol       
                          | • Clean drain pans; proper slope and drainage  
                          | • Use potable water for steam humidification  
                          | • Keep duct lining dry; move lining outside of duct if possible  
                          | • Fix leaks/clean spills (see filter change protocol)  
                          | • Maintain spotless mechanical room (not a storage area)  
                          | • Avoid back drafting  
                          | • Check/maintain flues from boiler to outside  
                          | • Keep combustion appliances properly tuned  
                          | • Disallow unvented combustion appliances  
                          | • Perform polluting activities during unoccupied hours  |
| **Moisture**            | • Keep building dry  |
| **Mold**                | • Mold and Moisture Control Protocol  |
| **Vehicles**            | • Use exhaust ventilation  
                          | • Maintain garage under negative pressure relative to the building  
                          | • Check air flow patterns frequently  
                          | • Monitor CO  |
| **Underground/attached garage** |                           |
# Outdoor Sources

The following table identifies common sources of contaminants that are introduced from outside buildings. These contaminants frequently find their way inside through the building shell, openings, or other pathways to the inside.

<table>
<thead>
<tr>
<th>Category/Common Sources</th>
<th>Tips for Mitigation and Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ambient Outdoor Air</strong></td>
<td>• Filtration or air cleaning of intake air</td>
</tr>
<tr>
<td>Air quality in the general area</td>
<td></td>
</tr>
<tr>
<td><strong>Vehicular Sources</strong></td>
<td>• Locate air intake away from source</td>
</tr>
<tr>
<td>Local vehicular traffic</td>
<td>• Require engines shut off at loading dock</td>
</tr>
<tr>
<td>Vehicle idling areas</td>
<td>• Pressurize building/zone</td>
</tr>
<tr>
<td>Loading dock</td>
<td>• Add vestibules/sealed doors near source</td>
</tr>
<tr>
<td><strong>Commercial/Manufacturing Sources</strong></td>
<td></td>
</tr>
<tr>
<td>Laundry or dry cleaning; restaurant; photo-processing;</td>
<td>• Locate air intake away from source</td>
</tr>
<tr>
<td>Automotive shop/gas station; paint shop; electronics</td>
<td>• Pressurize building relative to outdoors</td>
</tr>
<tr>
<td>Manufacture/assembly; various industrial operations</td>
<td>• Consider air cleaning options for outdoor air intake</td>
</tr>
<tr>
<td><strong>Utilities/Public Works</strong></td>
<td>• Use landscaping to block or redirect flow of contaminants, but not too close to air intakes</td>
</tr>
<tr>
<td>Utility power plant; incinerator; water treatment plant</td>
<td></td>
</tr>
<tr>
<td><strong>Agricultural</strong></td>
<td></td>
</tr>
<tr>
<td>Pesticide spraying; processing or packing plants; ponds</td>
<td></td>
</tr>
<tr>
<td><strong>Construction/Demolition</strong></td>
<td>• Pressurize building</td>
</tr>
<tr>
<td></td>
<td>• Use walk-off mats</td>
</tr>
<tr>
<td><strong>Building Exhaust</strong></td>
<td>• Separate exhaust or relief from air intake</td>
</tr>
<tr>
<td>Bathrooms exhaust; restaurant exhaust; air handler relief</td>
<td>• Pressurize building</td>
</tr>
<tr>
<td>Vent; exhaust from major tenant (e.g., dry cleaner)</td>
<td></td>
</tr>
<tr>
<td><strong>Water Sources</strong></td>
<td></td>
</tr>
<tr>
<td>Pools of water on roof; cooling tower mist</td>
<td>• Proper roof drainage</td>
</tr>
<tr>
<td></td>
<td>• Separate air intake from source of water</td>
</tr>
<tr>
<td></td>
<td>• Treat and maintain cooling tower water</td>
</tr>
<tr>
<td><strong>Birds and Rodents</strong></td>
<td></td>
</tr>
<tr>
<td>Fecal contaminants; bird nesting</td>
<td>• Bird proof intake grilles</td>
</tr>
<tr>
<td></td>
<td>• Consider vertical grilles</td>
</tr>
<tr>
<td></td>
<td>• Use Integrated Pest Management</td>
</tr>
<tr>
<td><strong>Building Operations and Maintenance</strong></td>
<td></td>
</tr>
<tr>
<td>Trash and refuse area; chemical/ fertilizers/ grounds</td>
<td>• Separate source from air intake</td>
</tr>
<tr>
<td>Keeping storage; painting/roofing/sanding</td>
<td>• Keep source area clean/lids on tight</td>
</tr>
<tr>
<td></td>
<td>• Isolate storage area from occupied areas</td>
</tr>
<tr>
<td>Category/Common Sources</td>
<td>Tips for Mitigation and Control</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Ground Sources</strong></td>
<td>• Depressurize soil</td>
</tr>
<tr>
<td>soil gas; sewer gas; underground fuel storage tanks</td>
<td>• Seal foundation and penetrations to foundation</td>
</tr>
<tr>
<td></td>
<td>• Keep air ducts away from ground sources</td>
</tr>
<tr>
<td><strong>Painting</strong></td>
<td>• Establish a protocol for painting and insure that the protocol is followed by both in-house personnel and by contractors.</td>
</tr>
<tr>
<td></td>
<td>• Use low VOC emission, fast drying paints where feasible.</td>
</tr>
<tr>
<td></td>
<td>• Paint during unoccupied hours.</td>
</tr>
<tr>
<td></td>
<td>• Keep lids on paint containers when not in use.</td>
</tr>
<tr>
<td></td>
<td>• Ventilate the building with significant quantities of outside air during and after painting. Insure a complete building flush prior to occupancy.</td>
</tr>
<tr>
<td></td>
<td>• Use more than normal outside air ventilation for some period after occupancy.</td>
</tr>
<tr>
<td></td>
<td>• Avoid spraying, when possible.</td>
</tr>
<tr>
<td><strong>Shipping and Receiving</strong></td>
<td>• Establish and enforce a program to prevent vehicle contaminants from entering the building.</td>
</tr>
<tr>
<td></td>
<td>• Do not allow idling of vehicles at the loading dock. Post signs and enforce the ban.</td>
</tr>
<tr>
<td></td>
<td>• Pressurize the receiving area relative to the outside to insure that contaminants from the loading area do not enter the building. Use pressurized vestibules and air locks if necessary.</td>
</tr>
<tr>
<td></td>
<td>• Periodically check the pressure relationships and compliance with the protocol.</td>
</tr>
<tr>
<td></td>
<td>• Notify delivery company supervisors of policy.</td>
</tr>
<tr>
<td>Category/Common Sources</td>
<td>Tips for Mitigation and Control</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------</td>
</tr>
</tbody>
</table>
| Managing Moisture and Mold | Mold thrives in the presence of water. The secret to controlling mold is to control moisture and relative humidity.  
  - Keep relative humidity below 60% (50%, if feasible, to control dust mites).  
  - Keep all parts of the building dry that are not designed to be wet.  
  - Adequately insulate exterior walls or ceilings to avoid condensation on cold surfaces.  
  - Insulate cold water pipes to avoid sweating.  
  - Clean spills immediately. Thoroughly clean and dry liquid spills on porous surfaces such as carpet within 24 hours, or discard the material.  
  - Do not allow standing water in any location.  
  - Maintain proper water drainage around the perimeter of the building.  
  - Provide sufficient exhaust in showers or kitchen areas producing steam.  
  - Thoroughly clean areas that are designed to be wet.  
  - Wash floors and walls often where water accumulates (e.g., showers).  
  - Clean drain pans often and insure a proper slope to keep water draining.  
  - Insure proper maintenance and treatment of cooling tower operations.  
  - Discard all material with signs of mold growth.  
  - Discard furniture, carpet, or similar porous material having a persistent musty odor.  
  - Discard furniture, carpet, or similar porous material that has been wet for more than 24 hours.  
  - Discard ceiling tiles with visible water stains. |
The IAQ Investigator’s Guide, 3rd edition
Edited by Ellen C. Gunderson, CIH, CSP

A good IAQ investigator is calm, observant, thorough, and discerning. They should be skilled in knowing what questions to ask, have knowledge of building systems, and possess a willingness to engage the public promptly and communicate results clearly to all involved parties. This guide discusses the initial investigation, an HVAC overview and inspection, and considerations for special indoor environments, risk communication, and report preparation. Eleven appendices are also included, providing the reader with guidelines, checklists, and forms to assist in their investigations.