Indoor air quality investigation

Introduction
The following information is intended to provide a safety professional with a uniform, logical approach for conducting initial indoor air quality (IAQ) investigations to solve most problems quickly and cost effectively. It is not intended to be an exhaustive treatment of the problem.

Background
The majority of people in the United States spend 90% of their time indoors. Therefore, the indoor air quality (IAQ) field is one of the more rapidly growing areas of environmental and public health. Industrial hygienists have been involved in IAQ diagnosis and remediation for the past 50 years. Specific methods of identifying and solving IAQ problems are not always available, but rather it is more like detective work. Clues and evidence are obtained, and a theory is formed and a solution may eventually be found. In many cases no source is identified. But solutions may still be applied. Since 50% of the IAQ problems are related to ventilation directly and in another 20% of the cases ventilation is the remedy to the problem. So, in many of the problems the solution is improved ventilation.

Approach
Begin with an immediate genuine investigation without being judgmental. A good initial approach to IAQ problems/complaints is:

1. Review the potential problem and collect background information.
2. Evaluate the situation (specific health and comfort complaints, time and location patterns of complaints, use questionnaires and checklists and review any medical opinions about the cause of illness).
3. Form theories as to what may be the cause.
4. Gather additional data (air sampling for specific contaminants, detailed inspection of HVAC system).
5. Suggest controls (ventilation, housekeeping, administrative).
6. Have a closing conference with all involved parties to effectively communicate finding, state any follow-up activities and close investigation.

Investigation
IAQ problems are often first recognized by occupants who complain. At this point it is important to conduct an open investigation and maintain good communication between building management and occupants. The focus of the investigation is to establish a causal relationship between the health effects and the building; not to prove or disprove the complaints.

Phase I: In the initial phase of the investigation the problem should be clearly defined so that an acceptable resolution can be attained. The goal is to develop information that will provide a means to draw a hypothesis and direct the investigation. Typically, IAQ problems have multiple causes, therefore the focus should not just be on the air or air contaminants; but should include areas such as lighting, ergonomic work station design and work place stress.

This phase involves:

- Review of historical information. The goal is to determine if the complaints are building related and what the potential causes are. Additionally, gather information on the building history (renovation, operation, and construction). Use checklists and questionnaires. Review the use of chemicals in the building (pesticides, cleaners and office machines).
- Initial walk through survey. Include the immediate outdoor area, the problem area, non-problem area and the major HVAC system components. No real measurements taken at this time, but observations of the overall workplace environment is key, such as lighting and background noise levels.
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- Occupant surveys of affected and unaffected workers. Survey should take place in person, and be confidential. Questions should focus on health affects and comfort as it relates to the building. Examine the total physiological and psychological demands of the work place; such as noise, lighting, ergonomics, and work stress.

- Review of HVAC design, operation and maintenance. A mechanical engineer familiar with the HVAC system will be helpful. Review air-exchange and thermal comfort balancing reports, and maintenance records. Look at air intake location and ensure that it is free from debris.

**Phase II:** In this semi quantitative phase, you are attempting to match possible cause and health effects reported. Characterize the complaints to the background information and form some hypotheses. What is the underlying cause and what are supporting causes? You will test your hypotheses by comparing information between affected and non-affected areas.

The phase involves:

- Comprehensive evaluation of the HVAC system
- Basic measurements, e.g., temperature, relative humidity, CO₂, and air movement. Sampling for specific air contaminants is not advised at this point and can be misleading
- Inventory potential source of contaminants in the building, identify the pathway to the occupants, and compare potential health affects to those of complaints

Since 50 percent of IAQ problems are ventilation related and ventilation is usually the main engineering resolution, it is here where we should focus most of our investigation and offer possible solutions. Modifications of the HVAC system to meet ASHRAE guidelines may resolve IAQ problems without investing numerous hours on a costly investigation to identify a particular contaminant that may or likely may not be present.

**Phase III:** This is a quantitative phase that most investigations do not reach. Environmental sampling for specific contaminants is not recommended primarily because the concentration levels rarely exceed standards and guidelines even when occupants continue to report health complaints. If it is to be done, the sampling strategy should be based on a comprehensive understanding of how the building operates and the nature of the complaints. There should be evidence that there is a probable cause for potential exposure to a specific contaminant.

### Common Pollutants and their Health Effects

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Health Effects</th>
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<tbody>
<tr>
<td>Bioaerosols/Bacteria</td>
<td>Legionnaires Disease or histoplasmosis or other infections</td>
</tr>
<tr>
<td>Molds</td>
<td>Allergic, Dermatitis</td>
</tr>
<tr>
<td>Pollen</td>
<td>Allergic</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>Dizziness, Headaches, Lethargy</td>
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<tr>
<td>Formaldehyde</td>
<td>Eye, Mucous Membrane Irritation</td>
</tr>
<tr>
<td>Fibrous Insulation</td>
<td>Dermatitis</td>
</tr>
<tr>
<td>Ozone</td>
<td>Respiratory Problems</td>
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<tr>
<td>Volatile Organic Compounds</td>
<td>Dizziness, Loss of Balance</td>
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</tbody>
</table>

### Timing patterns of complaints

**Symptoms beginning/or are worst at the start of the occupied period:**

- Review HVAC operating cycles. Pollutants from building materials, or from the HVAC system itself, may build up during unoccupied periods.

**Symptoms worsen over course of occupied period:**

- Consider that ventilation may not be adequate to handle routine activities or equipment operation within the building or that temperature is not properly controlled.
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Intermittent symptoms:
- Look for daily, weekly, or seasonal cycles or weather-related patterns, and check linkage to other events in or around the building.

Single event of symptoms:
- Consider spills, other unreported events sources.

Additional information is available in the Travelers document “Indoor Air Quality - Informative”

Reference
www.epa.gov

For more information, log in to the Risk Control Customer Portal at travelers.com/riskcontrol. (Need help? Read our Registration Quick Guide.) You also can contact your Risk Control consultant or email Ask-Risk-Control@travelers.com.