Body of Knowledge

Indoor Air Quality Practitioner
About AIHA®

Founded in 1939, the American Industrial Hygiene Association® (AIHA®) is one of the largest international associations serving the needs of industrial / occupational hygiene professionals practicing in industry, government, labor, academic institutions, and independent organizations.

For more information, visit www.AIHA.org

About IAQA

The Indoor Air Quality Association (IAQA) is a nonprofit organization dedicated to bringing practitioners together to prevent and solve indoor environmental problems for the benefit of customers and the public. IAQA was established in 1995 and is the nation’s largest indoor air quality trade association, with over 2,600 members and more than 20 local chapters across the United States and Canada.

More information visit www.IAQA.org
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Background

AIHA® and IAQA worked collaboratively to develop the technical framework, known as the Body of Knowledge (BoK), that outlines the knowledge and skills a competent person should possess and be able to demonstrate in indoor air quality (IAQ) assessments. In July 2013, a panel of subject matter experts was appointed to develop a BoK and subsequent job/task analysis survey to collect input, perspective, and feedback from relevant stakeholders to identify the essential knowledge and skills required for IAQ practice.

In October 2014, the job/task analysis survey was made available to external stakeholders, allied professionals and AIHA® and IAQA members and volunteers. The survey results were used to finalize the content for the IAQ Practitioner BoK.

The Body of Knowledge document was approved by the IAQA and the AIHA® Boards of Directors in 2015. In 2018, a team of both AIHA® and IAQA members and volunteers reviewed the BoK and provided an update to include management planning for IAQ issues. These updates were approved by both the IAQA and the AIHA Indoor Environmental Quality Committee in 2018.
Indoor Air Quality Practitioner

Definition

This document provides an organized summary of the collective knowledge and skills necessary for competent indoor air quality (IAQ) practice and covers a broad set of agents, building systems and related issues pertaining to indoor air quality. For the purposes of this document, the terms IAQ and IAQ practice are also intended to include indoor environmental quality (IEQ) conditions and parameters and IEQ practice. Different industries and monitoring scenarios may require different applications of the knowledge and skill sets. This Body of Knowledge (BoK) will be used by AIHA® and IAQA to establish a framework for the development of training programs, knowledge and skill assessment tools, and the improvement of the state of professional IAQ practice.

This BoK is not intended to define or stipulate employer hiring criteria. It is the employer’s responsibility to ensure that each employee understands his or her specific job and has met the minimum criteria established by relevant regulations, standards, and the specific industry, facility, or project.

1.0 | General Knowledge

1.1. Apply knowledge of general concepts in biology, chemistry, physics, microbiology and mathematics, as they relate to the IAQ practice.

1.2. Demonstrate an understanding of the definition of good IAQ.

2.0 | Contaminants and Stressors

2.1. Identify sources and pathways of common contaminants:
   • Bioaerosols (mold, bacteria, allergens, etc.)
   • Gases and vapors (radon, volatile organic compounds (VOCs), carbon monoxide (CO), carbon dioxide (CO₂), combustion gases, etc.)
   • Particles (particulate matter, asbestos, lead, etc.)

2.2. Identify sources and pathways of common physical stressors (noise, vibration, lighting, thermal comfort, ergonomics, etc.).

2.3. Recognize psychosocial factors (management and employee relationships, employer/employee relationships, employee-customer relationships and environmental changes, etc.) and the need for other specialized evaluation when encountered.
3.0 | Health Effects

3.1. Identify the broader occupant symptom patterns (as well as the role of medical professionals in diagnosis) and understand how they may impact resolution of the IAQ issue (sick building syndrome, mass psychogenic illness, building related illness, etc.).

3.2. Demonstrate an awareness and understanding of common building related illnesses (BRIs) and the need for diagnosis by medical professionals.

3.3. Demonstrate an understanding of the concept of sick building syndrome (SBS) and challenges associated with the ambiguous nature of SBS.

3.4. Demonstrate an understanding of the concept of MPI and the need for other professionals to address issues associated with MPI.

3.5. Demonstrate an understanding of both the specific and nonspecific health effects commonly encountered in IAQ incidents and their potential causes in the environment.

3.6. Demonstrate an understanding of practitioner limitations and the need for diagnosis to be conducted by medical professionals.

4.0 | Buildings and Building Systems

4.0.1 | Building Science

4.A.1. Assess the impact of building materials on IAQ.

4.A.2. Identify the common types of enclosure components and assemblies and their impact on IAQ.

4.A.3. Identify the building enclosure (roof, walls, floors, etc.).

4.A.4. Identify the core concepts of moisture movement through the building enclosure:
   - Drainage plane
   - Air barrier
   - Vapor retarder
   - Water infiltration
   - Air infiltration/exfiltration
   - Vapor diffusion
   - Plane of condensation
   - Water vapor permeability
   - Climate
   - Pressure differentials
4.0 | Buildings and Building Systems

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4.B | Heating, Ventilating and Air Conditioning (HVAC)

4.B.1. Demonstrate an understanding of the role of HVAC systems in an IAQ investigation and how HVAC design factors and maintenance may adversely impact IAQ.

4.B.2. Demonstrate an understanding of the fundamental operation of a typical HVAC system (generation equipment, distribution system, terminal equipment, applicable standards, outdoor air volumes, exhaust/intake relationships, ventilation rates, re-circulation, filtration, barriers, etc.).

4.B.3. Identify the common components of an HVAC system and how the equipment works together as a system (logic, design, etc.).

4.B.4. Demonstrate an understanding of the role and importance of how different spaces are used in the building, as well as their interactions, and their potential impact on indoor air quality concerns.

4.B.5. Demonstrate an understanding of the different types of ventilation (natural, mechanical, etc.), how to measure the ventilation, and how to ascertain the suitability of the ventilation.

4.B.6. Demonstrate an understanding of different air distribution systems and controls of the distribution systems (automation, sensors, etc.) and how they affect air delivery to the occupant space.

4.B.7. Conduct a visual inspection of filter assemblies.

4.B.8. Demonstrate an understanding of different filter efficiency scales, efficiency standards, types of filter categories, and how filtration impacts performance of the HVAC system.

4.B.9. Assess the impact of dew point temperature and surface temperatures in the space.

4.B.10. Assess pressure differences using measurement techniques.

4.B.11. Assess the impact of pressure differences on how contaminants, including moisture, move through the building.

4.B.12. Demonstrate an understanding of how stack effect, wind pressure, and pressure due to mechanical equipment impact air movement.


4.B.14. Demonstrate an understanding of the HVAC system’s impact on humidity control.

4.B.15. Recognize when outside HVAC engineering expertise is warranted.
5.0 | Assessments

5.A | Scoping

5.A.1. Identify the scope of an IAQ problem in terms of physical areas, people, timeframes and budget to appropriately focus investigative actions.

5.B | History

5.B.1. Demonstrate the importance of collecting building and occupant history; depending on the situation this may include, but not be limited to, location/setting, construction/renovation dates, previous land use, management structure, building and HVAC design/operation/maintenance records (blueprints, as-built reviews, etc.), occupant surveys/interviews and prior sampling and investigation data.

5.C | Data Gathering

5.C.1. Identify the components of an IAQ investigation, such as the collection of multiple data points including identifying the scope of the problem; collecting building and occupant history; walkthrough inspection observations, and potential environmental sampling.

5.C.2. Conduct an effective interview, extract valuable information, and avoid pitfalls in the interview process.

5.D | Scientific Method

5.D.1. Apply the scientific method to IAQ investigations.

5.D.2. Develop hypotheses regarding the potential causes of IAQ concerns, collect and evaluate data to test these hypotheses, and reach conclusions accepting or rejecting the hypotheses.

5.D.3. Apply critical thinking skills to differentiate between simple and complex IAQ concerns.

5.D.4. Demonstrate an understanding that hypotheses development begins before the initial walk-through and continues until resolution of the issue.

5.D.5. Recognize that, in some cases, simple solutions may be effective and should be a priority when developing recommendations.
5.E | *Walkthrough Inspection*

5.E.1. Demonstrate an understanding of the walkthrough inspection for fostering occupant communication and data collection.

5.E.2. Understand that the walkthrough inspection includes the area of concern, adjacent areas, and related building enclosure and HVAC systems.

5.E.3. Recognize common contaminant sources, pathways, and other problematic conditions in the field.

5.E.4. Identify what types of preliminary environmental measurements may be appropriate for an initial walkthrough.

5.F | *Sampling*

5.F.1. Recognize that sampling is not necessarily the best or first approach in determining the cause of IAQ issues.

5.F.2. Demonstrate the importance of evaluating the need and purpose of a clearly defined and communicated sampling plan prior to collection.

5.F.3. Demonstrate an understanding of background levels of contaminants and generally accepted exposure guidelines for indoor environments.

5.F.4. Demonstrate an understanding of how to select the most appropriate instruments and how data will be interpreted prior to collection.

5.F.5. Sample, analyze and interpret results related to common IAQ contaminants and conditions.

5.G | *Limitations*

5.G.1. Demonstrate an understanding of practitioner limitations and when additional expertise (HVAC engineers, medical professionals, architects, etc.) is necessary.

5.H | *Corrective Actions*

5.H.1. Recognize conditions that may require immediate emergency action relative to a building or individual occupants.

5.H.2. Demonstrate an awareness of when there is a need for immediate and/or long term action plans, including follow-up assessments.

5.H.3. Recommend corrective actions for common IAQ problems (remove, substitute, replace, etc.).
5.0 | Assessments

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5.1 | Communication

5.1.1. Demonstrate an understanding of the fundamentals of risk communication and methods of conflict resolution when interacting with stakeholder groups.

5.1.2. Demonstrate the importance of effectively communicating information (scope, observations, verified/unverified information, hypotheses, testing plans, findings, assumptions, uncertainties, conclusions, recommendations, references, etc.) to the client and other stakeholders.

6.0 | Mitigation of Indoor Air Quality Problems

6.1. Recognize the wide variety of indoor environmental concerns/problems (asbestos, radon, water intrusion, mold growth, VOC off-gassing, etc.).

6.2. Recognize and distinguish between human-related and building-related problems.

6.3. Identify appropriate responses and include them in the mitigation plan.

6.4. Identify commonly used containment equipment and engineering controls.

6.5. Identify personal protective equipment (PPE) to be used by workers involved in mitigation activities.

6.6. Design a mitigation plan and determine what success looks like.

6.7. Coordinate subcontractors during mitigation.

6.8. Demonstrate the importance of effective communication that includes all stakeholders throughout the process.
7.0 Design, Construction and Commissioning

7.1. Effectively communicate project purpose, objectives, and scope, and related costs and establish a list of key contacts.

7.2. Understand common building commissioning protocols/approaches to allow for the integration of indoor environmental quality concerns.

7.3. Apply proactive evaluation methods of all building products that enter the building and their impact on IAQ, including their impact on the HVAC system and noise.

7.4. Use evaluation methods criteria such as the U.S. Environmental Protection Agency’s (USEPA) “Tools for Schools” to determine the impact of building materials on IAQ.

7.5. Assess the potential life-cycle and cost impact of building materials on long-term IAQ issues in the building.

7.6. Understand the test methods and methodologies and apply them to modelling and physical commissioning.

7.7. Recognize and be able to recommend programs that evaluate or certify low-emitting construction materials, finishes and furniture.

7.8. Be familiar with sensitive products and furnishings, potential contaminants, processes, and conditions.

7.9. Be familiar with methods for preventing contamination (e.g., temporal displacement or physical protection) and adverse effects.

7.10. Understand how ventilation, air duct cleaning, and outdoor air interact to affect indoor air quality.

7.11. Understand approaches to flush out contaminants prior to occupancy.

7.12. Promote the concept of having accessibility to the HVAC system for O&M and IAQ evaluation.

7.13. Demonstrate the ability to develop procedures for water intrusion events and response measures.

7.14. Understand the separate functions of air, vapor, and weather resistive barriers and how they relate to microbial growth in the buildings.

7.15. Recognize the HVAC system verification checks (e.g., demand-controlled ventilation, minimum ventilation requirements)
7.16. Understand and be able to sample for available parameters for verification such as, but not limited to, temperature, relative humidity, $\text{CO}_2$, particulate matter ($\text{PM}_{10}/\text{PM}_{2.5}$), sulfur dioxide ($\text{SO}_2$), nitrogen dioxide ($\text{NO}_2$), CO, ozone ($\text{O}_3$), lead (Pb), formaldehyde, total volatile organic compounds (TVOCs), microbials, and ventilation rates.

7.17. Be able to identify and select appropriate target values for verification.

7.18. Understand the process of using questionnaires to assess post-occupancy comfort as part of commissioning.

8.0 | Operations and Maintenance (O&M)/Occupancy

8.1. Understand the methods/tools for evaluating occupant satisfaction.

8.2. Understand tools for tracking incidents that may impact occupant satisfaction and documenting applicable response actions.

8.3. Review incident logs for trends and make appropriate recommendations.

8.4. Understand source reduction, including selection of furniture, fixtures, and equipment (FFE) and adequate outside air ventilation as proactive approaches to IAQ.

8.5. Recognize the potential impact of proactive approaches throughout the life cycle (design, construction, renovation, and operation) of a building.

8.6. Recognize the independent contributions and the interaction of building enclosure and HVAC for the prevention of dampness in buildings.

8.7. Understand the cost impacts of factors that affect IAQ (e.g., design flaws are cheaper to fix before construction, construction defects are easier to see in mock-ups than on drawings, in many climates/seasons a flush out can have large energy costs, the sequencing of construction activities can increase cost but prevent VOC sorption into porous materials).

8.8. Recognize the importance of cleaning processes/materials and an appropriate pest management program for satisfactory IAQ in an occupied building.
8.0 | Operations and Maintenance (O&M)/Occupancy

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8.9. Demonstrate the ability to develop, implement and maintain an IAQ management plan for the operation of buildings to enhance IAQ through practices that prevent the development of IAQ problems in buildings, correct IAQ problems when they occur and maintain the well-being of the occupants.

8.10. Demonstrate the ability to develop processes and schedules for preventive maintenance activities to prevent IAQ problems from developing.

8.11. Demonstrate the ability to evaluate work practices and materials and educate occupants and workers on activities and materials that may impact IAQ to maintain the well-being of the occupants.

8.12. Demonstrate the ability to develop plans to sequence and schedule a renovation to minimize IAQ impacts.

8.13. Understand how to compartmentalize the renovation area, including the HVAC, to prevent cross-contamination of construction-generated contaminants into occupied space.
