

Indoor Air Quality Consulting

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There is a growing market for qualified consultants specializing in indoor air quality services. The architect's integrated knowledge of building materials and systems is an excellent foundation for acquiring expertise in this emerging specialty area.

Indoor air quality consultants monitor the sources and concentrations of airborne contaminants, diagnose problems, and recommend remediation strategies. Clearly, indoor air quality problems are a nightmare for building owners. Building owners and managers are the primary defendants in the ever-increasing volume of lawsuits related to indoor air quality, but liability for injuries suffered by plaintiffs can (and in some cases does) extend to anyone involved in the design, leasing, and construction of the building, including, of course, architects.

Indoor air quality (IAQ) first gained widespread attention within the building industry in the late 1970s and early 1980s, when IAQ problems began to appear in buildings that were tightly constructed to minimize air infiltration in order to reduce energy consumption, but which did not allow adequate ventilation. At the same time more petroleum-derived chemicals began to be used in building materials. Subsequently some high-profile cases of sick building syndrome (SBS) and building-related illness (BRI) were reported, bringing the indoor air quality issue to the attention of the general public. During the past decade professionals in the medical community have dramatically increased their knowledge of BRIs, and better sampling and analytical methods have improved our ability to detect contaminants. All of these trends have led to a growing awareness of IAQ issues among building owners, building occupants (employees and tenants), and the legal and medical professions. This situation translates directly into a rapidly expanding market for IAQ consulting services.

The U.S. Environmental Protection Agency (EPA) has determined that the average U.S. citizen spends 90 percent of his or her time indoors, and indoor air pollution levels can be up to 96 times greater than outdoor pollution levels. This makes IAQ one of the greatest health concerns in this country.

CLIENT NEEDS

There are three basic types of circumstances in which IAQ consulting services are sought: existing facilities where there are complaints; new facilities; and existing facilities during renovation. While IAQ complaints generate many clients, architects especially have the motivation to heighten their clients' awareness of the need for air quality monitoring in new buildings and during renovation projects. Increasingly, routine IAQ monitoring is required in those circumstances, and in the future is likely to be considered the standard of practice.

Technically, a "sick building" is one in which more than 20 percent of occupants dis-

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Summary

INDOOR AIR QUALITY CONSULTING

Why a Client May Need These Services

- ▶ To respond to user complaints about indoor air quality
- ▶ To validate the environmental quality of indoor spaces
- ▶ To rectify the causes of indoor air contamination
- ▶ To foster higher productivity through optimal environmental conditions

Knowledge and Skills Required

- ▶ Knowledge of sources and types of indoor contaminants
- ▶ Familiarity with measuring and sampling procedures
- ▶ Knowledge of testing protocols
- ▶ Knowledge of environmental standards and benchmarks
- ▶ Understanding of health effects of indoor contaminants
- ▶ Familiarity with environmental regulations (e.g., OSHA, NIOSH, etc.)

Representative Process Tasks

- ▶ Establish objectives and benchmarks
- ▶ Sample and measure IAQ
- ▶ Analyze and evaluate results of testing
- ▶ Develop remediation plans

play symptoms of illness for more than two weeks, and the source of these illnesses cannot be positively identified. The most common complaints are headache, burning or itchy eyes, skin irritation, respiratory difficulties, nausea, and fatigue. Poor air quality can have a significant impact on worker health and productivity. Noise and poor lighting often exacerbate symptoms related to IAQ problems.

Many buildings with significant indoor air quality problems are not technically classified as sick buildings. Where contaminants cause allergic reactions, for example, about 20 percent of the population is likely to be sensitive to the allergen—a level often below that required for the sick building classification. In many cases where occupants experience allergic reactions, investigators fail to identify a specific cause. Where a cause of a specific illness or disease can be determined, the building occupants may be determined to have a BRI. In one well-documented case in a low-income housing project in Cleveland, for example, 37 children suffered from pulmonary hemosiderosis, an illness characterized by bleeding in the lungs. The illnesses were linked to a mold that grows in areas with considerable moisture, such as residences with leaky pipes. Less understood but also of concern is multiple chemical sensitivity, in which a variety of symptoms can occur and disappear in response to low levels of various chemicals.

The list of potential contaminants in indoor environments is long (about 900) and varied. Examples of contaminant sources include chemicals used in work processes (e.g., volatile organic compounds such as dry-cleaning chemicals, paint, laboratory chemicals, glues, hair sprays); release of harmful gases from building materials (fiberboard, carpet, glue); improper filtration and ventilation; microbial growth (fungus, mold, bacteria, virus) which is often moisture-related, in carpet, walls, ductwork, or other areas; pest infestation; pesticide contamination; particulate matter (fiberglass, asbestos, dust, sawdust); combustion by-products; or outdoor air pollutants (ground-level ozone, smoke). Each building environment is unique, and often a mixture of contaminants is involved.

Building owners and building management firms that suspect their building has SBS are a major source of clientele for IAQ consultants. Such clients are often under considerable pressure. In some cases employers are challenged both legally and financially when physicians order employees who are suffering symptoms apparently related to indoor air quality not to return to the building. Landlords are similarly threatened by complaints from tenants, and they fear loss of rental or lease income. In situations such as these the client needs someone to determine the source of the problem and remedy it as fast as possible.

In other cases, the building owner may be aware of the source of the problem and simply require remediation advice. Buildings with moisture problems, for example, frequently develop mold and fungus infestations, and the owner or building manager may be aware of this potential and want advice about how to improve IAQ. Standing water in air-conditioning condensate pans, chronic water spills, and leaky plumbing fixtures are common sources of moisture-related IAQ problems. In other cases, the owner may not be aware of a specific problem but wants assurance that the building air quality is acceptable. Owners of older buildings often fall into this category. Owners of buildings constructed during the energy crisis of the 1970s and early 1980s may be aware of potential lack of outside air in the heating, ventilation, and air-conditioning (HVAC) systems. Owners of even older buildings may suspect improper ventilation of very old mechanical equipment, microbial growth, or pest infestation.

In new facilities the objective will be to make sure the systems are working correctly. Ideally, “correctly” will have been defined by performance criteria for indoor air quality that have been included in the building program. Often postcommissioning air monitoring checkups may also be required periodically (perhaps quarterly, semiannually, or annually). Laboratories, factories, and hospitals often require this monitoring to satisfy Occupational Safety and Health Administration (OSHA) regulations.

Ideally, indoor air quality monitoring will be part of the commissioning process for all new buildings as part of a coordinated building systems shakedown process. Clients are beginning to require IAQ commissioning as part of the HVAC contractor’s responsibility.

A growing number of clients are implementing a proactive program to ensure a healthy building. These clients want to assure their employees or tenants that they are doing everything they can to make the work or residential environment healthy. Benefits for the client who is an employer may include a recruiting advantage, lower absentee rates, and higher productivity. The client who leases or rents space may gain a marketing advantage from the “healthy building” label. The EPA estimates that over \$1 billion in direct medical

 **The selection of construction materials and the design of HVAC systems that contribute to IAQ are part of sustainable design.**

costs each year can be attributed to IAQ problems, and at least \$60 billion is lost in decreased productivity (compared with \$4.7 billion to \$5.4 billion from major illnesses not related to air quality). As awareness of IAQ issues continues to spread, the number of clients interested in proactive services will increase.

Attention to indoor air quality issues is very important during renovation projects, especially where one part of a facility is undergoing renovation while another part remains occupied. In these cases, the construction work area must be contained so that pollutants do not circulate into the occupied area. Common contaminants generated by renovation include potentially carcinogenic substances contained in or released from building materials (drywall, floor tile, mastic, lead paint, fiberglass, or asbestos) and mold-infested sawdust. Improper ventilation from painting or mastics application can be a problem in occupied buildings. In addition to ensuring proper containment of the work area, the IAQ consultant will review and monitor ventilation standards and monitor contamination levels on the perimeter of the work site. Hospitals and other health care facilities are a major market for IAQ services during renovation projects, because airborne fungal spores and other contaminants that most healthy individuals can tolerate may be fatal to immune-compromised patients.

Many IAQ consultants are industrial hygiene firms or indoor air quality specialists. While there are many well-qualified firms, unfortunately there are some practicing in this field who lack adequate professional background—some, for example, come primarily from an HVAC contracting background (see section on skills, below). The best-qualified usually offer industrial hygiene and mechanical engineering expertise but often lack cross-cutting knowledge of buildings and building systems.

Architects are well qualified to become IAQ specialists, particularly where design is involved. With the advent of “green” buildings, more and more clients are asking for a proactive IAQ program. There is abundant opportunity for architects in this field. Indoor air quality consulting can be packaged with related services, such as building design and documentation, construction administration, commissioning, sustainable design, energy analysis, energy monitoring, and building management.

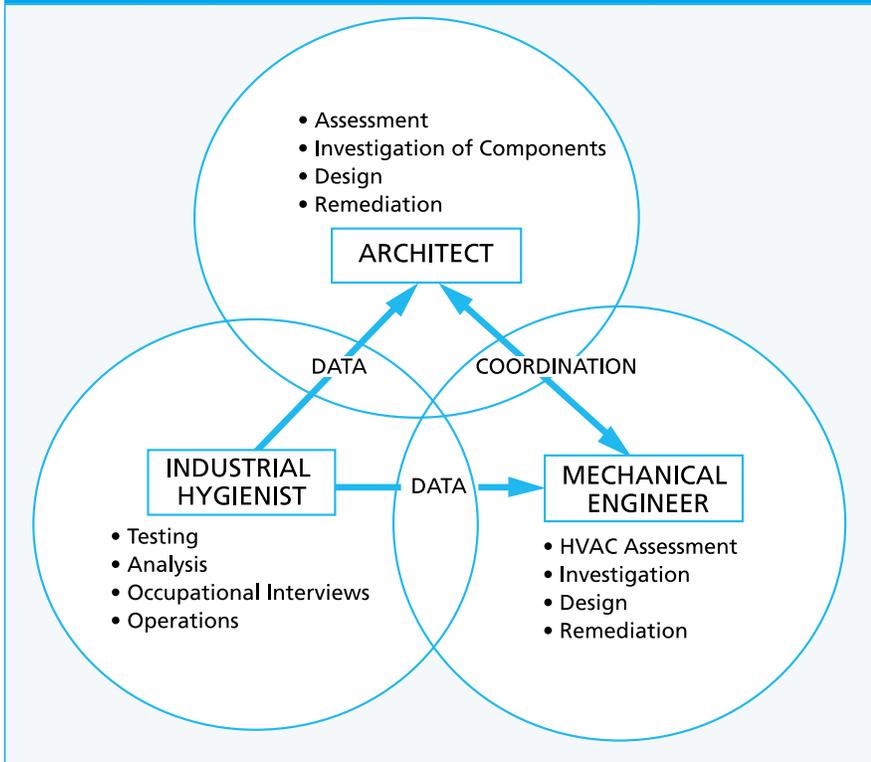
 **Commissioning services encompass indoor air quality and energy use issues, among others.**

SKILLS

As noted above, opportunities abound for architects interested in pursuing an IAQ specialty. Architects entering the indoor air quality consulting field need to acquire adequate background knowledge and to team with well qualified professionals from other disciplines. The architect’s integrative knowledge of building design is invaluable when designing for optimal indoor air quality in a new facility. Architects also have valuable client interaction skills that the more technically oriented team members may lack. Clients experiencing difficult indoor air quality challenges may be particularly appreciative of communications and diplomacy skills. An architect can explain the problem and outline options for remediation in language clients can understand. Architects also have broad building technology knowledge that other team members—and many consultants—may lack. Where IAQ problems can be traced to moisture infiltration, for example, the architect is well qualified to determine the source of the problem—walls, roof, or condensate, or perhaps a poorly installed vapor barrier—and recommend a remediation strategy. When problems can be traced to certain building materials, the architect is well qualified to recommend a substitute material and to advise on how to remove the problem material and install the new one.

An architect with project management experience will have skills as a team leader that are important in indoor air quality consulting. The IAQ team’s collective knowledge should include expertise in both science and buildings. The team ideally should include industrial hygienists, mechanical engineers, building maintenance professionals, field technicians, and an architect or other person knowledgeable about building materials, design, and technology and trained in IAQ. Specific knowledge that the team should have includes the sources and types of indoor contaminants; sampling and testing protocols; health effects of contaminants; relevant standards and regulations (e.g., American Society of Heating, Refrigerating, and Air-Conditioning Engineers [ASHRAE], EPA, National Institute for Occupational Safety and Health [NIOSH], OSHA); chemistry, biology, and microbiology; building systems (especially HVAC); and construction materials.

Interdisciplinary Relationships in IAQ Consulting



Ronald V. Gobbell, NCARB ADVP-2
Indoor Environment (1994)

Increasingly, regulations reference or require IAQ monitoring to be conducted by a certified industrial hygienist (CIH)—an industrial hygienist who is certified by the American Board of Industrial Hygienists. Certification requirements include a relevant four-year degree, five years of field experience, two exams, and continuing education requirements. The designation also carries more weight in litigation.

The architect embarking on a career in indoor air quality consulting can access a growing number of books, publications, workshops, and other resources on the subject. Because this field is evolving so rapidly and because it so directly involves public health and welfare and potential litigation, the architect and all the team members have an obligation to pursue continuing education in order to keep their knowledge current.

A/E firms seeking IAQ projects may wish to team with mechanical and electrical engineering firms, industrial hygiene firms, or firms specializing in

indoor air quality services. Depending on the project, specialists often are required. They might include specialists in environmental design and healthy buildings, mechanical engineers who specialize in indoor air quality, testing laboratory technicians, mycologists, test and balance specialists, and air filtration specialists.

IAQ monitoring requires sampling equipment for monitoring carbon monoxide, carbon dioxide, temperature, and relative humidity, and volumeters to measure airflow speed.

Architecture firms should consult their professional liability insurance carrier before beginning to offer IAQ services. Professional liability insurance is a must for those involved in IAQ consulting. The firms that insure design professionals are beginning, after some initial reluctance, to insure IAQ consulting practices. Insurance companies that specialize in the environmental field are another alternative.

PROCESS

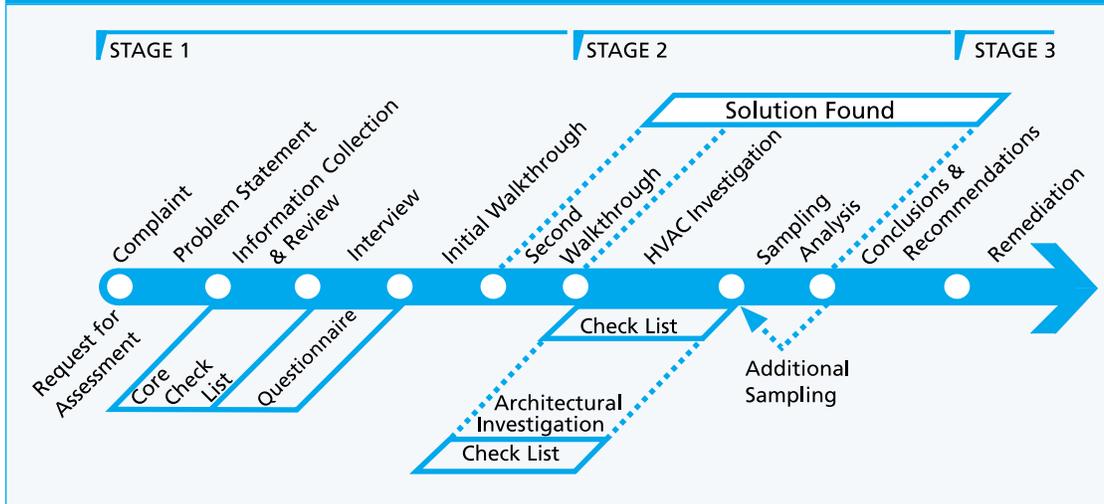
The approach to the work depends somewhat on the circumstances under which the service is required, although the basic work process remains the same.

Project objectives. The process always begins with the establishment of project objectives. The objectives might be stated in quantitative benchmarks for IAQ in the case of new construction or renovation. For a complaint-driven project, a problem statement would be developed, and the objective would be to analyze the problem and recommend remediation procedures, if possible.

Information gathering. Information gathering is the next step. A variety of on-site and off-site investigation techniques may be used. Building walk-throughs and interviews are usually a first step. The investigators may use a series of checklists to thoroughly assess the building, covering general information about the facility, HVAC systems, and architectural components. The flow of air through the building may be documented if necessary to determine the source of a problem.

Sampling and measurement. Next, the industrial hygiene and engineering members of the team use sampling and measurement procedures to collect information about substances present in the building's air. These procedures may be either qualitative or quantitative. Qualitative procedures indicate only whether a substance has been identified in the

IAQ Diagnostic Procedure



Ronald V. Gobbell, NCARB ADVP-2 Indoor Environment (1994)

sample submitted to the laboratory (e.g., the sampled air analyzed positive for benzene; the flooring material analyzed positive for asbestos). Qualitative procedures both identify the substance and allow a numerical expression of the amount of the substance contained in a given volume of air or within a given amount of some other material (e.g., the sampled air contains 5 mg/m³ of benzene; the flooring material contains 45 percent chrysotile asbestos in the backing layer). Qualitative procedures may be faster and less expensive than quantitative ones and may be used to gain preliminary information when the presence of a substance is suspected. Qualitative information may be collected as a precursor to quantitative sampling.

Analysis and evaluation. A combination of on-site and off-site laboratory tests are used to analyze and evaluate the data gathered.

Developing recommendations and plans. The entire IAQ team must collaborate to diagnose the situation and develop recommendations and perhaps specific plans for remediation where necessary.

Follow-up. Retesting to ensure that the expected results have been achieved is a necessary follow-up service. Ideally, retesting will be combined with other proactive measures to ensure that problems do not occur or recur.

The usual phasing of services involves a broad screening phase to determine general conditions; a second, finer screening phase to focus on more specific issues; and ongoing proactive services to ensure continued indoor air quality. Deliverables commonly include reports on the results of testing and evaluation, recommendations, remediation plans, and training of building operations and maintenance personnel—or, in the case of renovation projects, construction personnel.

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The AIA provides a contract document designed especially for alternative architectural services.

B102–2007, Standard Form of Agreement Between Owner and Architect without a Predefined Scope of Architect’s Services.

AIA Document B102–2007 is a standard form of agreement between owner and architect that contains terms and conditions and compensation details. B102–2007 does not include a scope of architect’s services, which must be inserted in Article 1 or attached as an exhibit. Special terms and conditions that modify the agreement may be included in Article 8.

The separation of the scope of services from the owner/architect agreement allows users the freedom to append alternative scopes of services.

AIA Document B102–2007 replaces and serves the same purpose as AIA Document B141–1997 Part 1.

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