

About This Document

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BEFORE YOU BEGIN

The goal of this guidance document is to help you prevent indoor air quality problems in your building and resolve such problems promptly if they do arise. It recommends practical actions that can be carried out by facility staff, outside contractors, or both. The document will help you to integrate IAQ-related activities into your existing organization and identify which of your staff have the necessary skills to carry out those activities.

This is a long document. It would be convenient if all of the ideas it contains could be summed up in a few short recommendations, such as: “check for underventilation” and “isolate pollutant sources.” However, such statements would only be helpful to people who are already familiar with indoor air quality concerns. If the owner’s manual for your car said to check your pollution control valves every year, but didn’t say how to find out whether they were working properly, you would need either a more detailed manual or the money to hire a mechanic. Don’t be discouraged by the number of pages in your hands. Once you begin to understand the factors that influence indoor air quality in your building, you can move from section to section, reading what you need to know at the moment and leaving the rest until later.

Some Basic Assumptions

EPA and NIOSH recognize that many factors influence how an individual owner or manager can put the information in this guide to use. The skills of facility staff and the uses of the building can vary widely,

affecting the types of IAQ problems that are likely to arise and the most effective approach to resolving those problems.

The assumptions used in preparing this guide include:

- The expense and effort required to prevent most IAQ problems is much less than the expense and effort required to resolve problems after they develop.
- Many IAQ problems can be prevented by educating facility management, staff, and occupants about the factors that create such problems. When IAQ problems do arise, they can often be resolved using skills that are available in-house.
- The basic issues and activities involved in preventing and resolving IAQ problems are similar for buildings of many different designs and uses.
- If outside assistance is needed to solve an IAQ problem, the best results will be achieved if building owners and managers are informed consumers.

How this Guide is Organized

This guide is divided into topic areas marked by tabs. **Tab I** marks introductory material directed toward all users of the document. **Tab II** is directed to building owners and facility managers who do not have a current IAQ problem and want to prevent such problems from arising. If you currently have an indoor air quality problem, **Tab III** provides guidance to help resolve that problem. The appendices marked by **Tab IV** present information that may not be critical to resolving most indoor air quality problems but could be useful reading for additional background

on major IAQ topics. Abbreviated sample forms are included throughout the text so that readers can see what types of information can be collected using the forms provided in this document. **Tab V** contains the complete forms discussed in the text. These can be photocopied for use by you and your staff.

As you read this document, you will find that some guidance points are repeated. This was intentional, as it allows you to use the sections on prevention, diagnosis, and mitigation as “stand-alone” guides.

Tab I: Basics

Section 2: Factors Affecting Indoor Air Quality

Indoor air quality is not a simple, easily defined concept like a desk or a leaky faucet. It is a constantly changing interaction of a complex set of factors. Four of the most important elements involved in the development of indoor air quality problems are: a source of odors or contaminants; a problem with the design or operation of the HVAC system; a pathway between the source and the location of the complaint; and the building occupants.

Read *Section 2* for an introduction to the factors that influence indoor air quality. A basic understanding of these factors is critical to investigating and resolving IAQ problems.

Section 3: Effective Communication

An effective communication system helps facility managers, staff, contractors, and occupants to clarify their responsibilities and cooperate in identifying potential IAQ problems. Building occupants can be valuable allies in resolving indoor air quality problems. On the other hand, even small problems can have disruptive and potentially costly consequences if occupants become frustrated and mistrustful. Effective communications are the key to cooperative problem-solving.

Good communications can be promoted through a group that represents all of the interested parties in the building. Many organizations have health and safety committees that can fill this role. *Section 3* suggests ways to work productively with building occupants to prevent IAQ problems and to maintain good communications during IAQ investigations.

Tab II: Preventing IAQ Problems

Section 4: Developing an IAQ Profile

An IAQ profile is a “picture” of building conditions from the perspective of indoor air quality. A review of construction and operating records, combined with an inspection of building conditions, helps to reveal potential indoor air problems and identify building areas that require special attention to prevent problems in the future. Baseline data collected for the IAQ profile can facilitate later investigations, should problems arise. *Section 4* suggests a three-stage approach to developing an IAQ profile and describes the products of each stage.

Section 5: Managing Buildings for Good IAQ

Many indoor air problems can be prevented by following common sense recommendations, such as: maintain good sanitation, provide adequate ventilation, and isolate pollutant sources. Other preventive measures may require a careful review of job descriptions, contracts, supplies, and schedules. It is important to designate an IAQ manager to bear responsibility for coordinating the effort in your building. *Section 5* discusses key elements to include in your IAQ management plan.

Tab III: Resolving IAQ Problems

Section 6: Diagnosing IAQ Problems

Most IAQ investigations begin in response

to a complaint from one or more building occupants. IAQ complaints can affect entire buildings or be limited to areas as small as an individual work station. The goal of the investigation is to resolve the complaint without causing other problems.

Section 6 describes a variety of information-gathering strategies used to identify the cause of an IAQ problem. This section provides suggestions for in-house staff who have been given the responsibility of investigating the problem. It will also help building management to understand and oversee the activities of any outside professionals who may be brought in to assist in the investigation.

Section 7: Mitigating IAQ Problems

The basic approaches to mitigating indoor air quality problems are: control of pollutant sources; modifications to the ventilation system; air cleaning; and control of exposures to occupants. Successful mitigation often involves a combination of these techniques.

Section 7 provides criteria for judging potential mitigation strategies and for determining whether a problem has been solved. It includes brief descriptions of common indoor air quality problems and possible solutions.

Section 8: Hiring Professional Assistance to Solve an IAQ Problem

Indoor air quality is an emerging and interdisciplinary field. *Section 8* provides guidance in hiring professional assistance if you decide that outside expertise is needed to determine the cause of an IAQ problem.

Tab IV: Appendices

Appendix A: Common IAQ Measurements – A General Guide

Appendix A describes measurement techniques that are commonly used for

IAQ investigations. If you are responsible for developing an IAQ profile or investigating an IAQ complaint, *Appendix A* provides suggestions for collecting and interpreting information on: temperature and humidity; airflow patterns; carbon dioxide; ventilation (outdoor) air quantities; and commonly measured environmental contaminants.

Appendix B: HVAC Systems and IAQ

Appendix B presents basic information on HVAC system designs and components and their effects on indoor air quality. This appendix is designed to accompany the HVAC Checklists in Tab V.

Appendix C: Moisture, Mold and Mildew

Appendix C discusses indoor moisture and its relationship to mold and mildew growth. The role of humidity in creating mold and mildew problems is often misunderstood because relative humidity readings taken in the breathing zone of an occupied space give little indication of conditions at the wall and ceiling surfaces or in the wall cavities. This appendix describes ways in which to evaluate how moisture may be causing indoor air quality problems and how successful different mitigation measures may be in reducing those problems.

Appendix D: Asbestos

Appendix D is a brief discussion of asbestos. If asbestos is a concern in your building, this appendix and the *Appendix G* section will direct you to sources of detailed guidance.

Appendix E: Radon

Appendix E is a brief discussion of radon. To learn more about how to check for radon in your building, refer to this appendix. *Appendix G* will direct you to

other sources of information.

Appendix F: Glossary and Acronyms

Appendix F explains scientific and engineering terminology that may be unfamiliar to some readers.

Appendix G: Resources

Appendix G is intended for readers who want to pursue more detailed information about indoor air quality. It includes the names, addresses, and telephone numbers of Federal, State, and private sector organizations with interests related to IAQ, as well as a list of selected publications.

Contaminant emission and movement in buildings is an emerging field of study. Building owners, facility managers, and engineers are urged to keep abreast of new information through professional journals and seminars in addition to relying on the guidance presented in this document.

Tab V: Indoor Air Quality Forms

Tab V contains a full set of the forms described in Tabs II and III. Building managers are encouraged to reproduce and use these blank forms. You may want to modify elements of these forms to reflect conditions in your particular building.

WARNING

Please note the following as you prepare to use this manual:

- Modification of building functions to remedy air quality complaints may create other problems. A thorough understanding of all of the factors that interact to create indoor quality problems can help to avoid this undesirable outcome.
- The guidance in this document is not intended as a substitute for appropriate emergency action in the event of a hazardous situation that may be imminently threatening to life or safety.
- The implementation of mitigation recommendations reached as a result of an indoor air quality evaluation should always be done in accordance with local laws and good practice. Changes to the overall design and operation of the building may necessitate the involvement of a registered professional engineer or other registered or certified professionals.
- In the event that medical records are utilized in the course of evaluating an IAQ problem, appropriate legal confidentiality must be maintained.