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Building Air Quality Action Plan

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To be used with Building Air Quality: A Guide for Building Owners and Facility Managers (EPA/400/1-91/033, DHHS (NIOSH) Pub. No. 91-114)

BAQ Action Plan

An Overview of EPA's Large Buildings IAQ Management Practices Guidance

Managing a building is a difficult and complex job. There are many competing demands – health and safety, building maintenance, housekeeping, and communications with occupants and tenants. Building owners and managers are under pressure to contain or reduce operating costs and increase revenues. Such fiscal pressures can easily draw attention and resources away from important elements of building management such as indoor air quality (IAQ).

Over the past twenty years, indoor air quality has emerged as a major concern for building owners and managers. As the public recognizes the importance of healthy, comfortable and productive indoor environments, its awareness and demand for good IAQ increases. People spend about 90 percent of their time indoors and air within homes and other buildings can be more polluted than the outside air, even in the largest and most industrialized cities. U.S. Environmental Protection Agency (EPA) studies that compare risks of environmental threats to public health consistently rank indoor air pollution (including secondhand smoke, radon, organic compounds and biological pollutants) among the top five.

Maintaining a healthy and comfortable indoor environment in any building requires integrating many components of a complex system. Indoor air problems are preventable and solvable and practical guidance on how to manage your building for good indoor air quality is available.

The core of EPA's large buildings IAQ management practices guidance is contained in *Building Air Quality: A Guide for Building Owners and Facility Managers* (*BAQ*), widely recognized as one of the best references of its type since publication in 1991 (see Appendix 1 for ordering information. This publication is also available on the World Wide Web at **www.epa.gov/iaq/largebldgs/baqtoc.html**). Much of what *BAQ* recommends you will recognize as common principles of good facility management. It is organized as a comprehensive reference volume, by subject area. As such, *BAQ* is extremely useful in learning the principles of IAQ and how to manage a building for good IAQ. It is also a helpful resource if problems occur or if more detailed information is needed. However, despite *BAQ*'s wide availability, EPA and other organizations continue to learn about indoor air problems that could have been easily prevented or fixed by implementing good building management practices.

It is worth noting that the guidance emphasizes changing *how* you operate and maintain your building, *not increasing the amount of work or cost* of maintaining your building. Good IAQ does not have to compete with other building management priorities; in fact, it can enhance some. For example, the efficiencies gained by keeping your HVAC system clean and better controlled both enhance IAQ and reduce energy costs.

To promote the use of these straightforward practices to improve IAQ, EPA and other leaders in the IAQ field developed this 8-step *Building Air Quality Action Plan* (*BAQ Action Plan*). This additional resource meets the needs of building owners and managers who want an easy-to-understand path for taking their building from current conditions and practices to the successful institutionalization of good IAQ management practices. The *BAQ Action Plan* leads you through a logical set of steps to achieve the goal of better indoor air quality in your building. There is broad agreement that both documents, *BAQ* and the *BAQ Action Plan*, used together, can significantly improve IAQ and reduce the likelihood of IAQ problems, thus lowering health risks, increasing comfort and productivity, and reducing exposure to liability from IAQ problems.

The *Building Air Quality Action Plan* is intended to be used in concert with the more comprehensive *Building Air Quality: A Guide for Building Owners and Facility Managers* (*BAQ*).

In order to use the *Building Air Quality Action Plan* effectively, one must have a thorough understanding of the concepts and practice of managing indoor air quality, an understanding that can be gained from a thorough reading of *BAQ*. In addition, there is extensive internal referencing in this *BAQ Action Plan* to the original *BAQ* guide, making it helpful and easy to use both documents together.

If you do not currently own a copy of *BAQ*, please refer to Appendix 1 for ordering information or visit EPA's World Wide Web site, at **www.epa.gov/iaq/pubs**.

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Indoor Air Quality Actions

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Step 7 Communicate with Tenants and Occupants About Their Role in Maintaining Good IAQ

Step 8 Establish Procedures for Responding to IAQ Complaints

BAQ Action Plan

Step 1: Designate an IAQ Manager

Reference: *Building Air Quality*: Section 5, "Managing Buildings for Good IAQ: Select an IAQ Manager," Page 33; also Section 3, "Communicating with Building Occupants," Page 13.

Purpose: To designate someone who is responsible for IAQ activities within a building.

The first step to good IAQ management is to assign the job of IAQ Manager. The IAQ Manager should be an employee of the building owner or manager and may be responsible for indoor air quality in more than one building. Once designated, the IAQ Manager will be responsible for implementing the rest of the Action Plan. The IAQ Manager may choose to seek assistance from outside contractors or consultants, but should retain primary responsibility.

Specific Activities:

- ☑ Choose an IAQ Manager to meet criteria in the *Building Air Quality* guide.
- ☑ Educate the IAQ Manager on the *Building Air Quality* guide.
- ☑ Have the IAQ Manager implement the Action Plan using the Checklist as a final check.

The IAQ Manager coordinates all indoor air quality activities in the building. Having overall responsibility makes it easier to manage the building's IAQ and keep occupants informed and involved.

An effective IAQ Manager can come from a variety of backgrounds. Indoor air quality is a field that requires the application of many disciplines to prevent and solve problems, because no single field encompasses all the needed principles and skills. The person selected could be the facility manager, the building operating engineer, the health and safety director, or the employee-relations manager. Whatever the job title, the IAQ manager should be given sufficient authority to make decisions and implement improvements.

Keep in mind that the IAQ Manager will be working as a "team leader". Where specific skills are lacking, another team member may compensate. Nevertheless, it is critical that the IAQ Manager be familiar with the building's structure and function and sufficiently conversant with IAQ issues to communicate effectively with occupants, facility personnel, and the building owner(s).

It is essential that the IAQ Manager be thoroughly familiar with the principles contained in *Building Air Quality: A Guide for Building Owners and Facility Managers* (*BAQ*) (see Appendix 1 for ordering information. This publication is also available on the World Wide Web at **www.epa.gov/largebldgs/baqtoc.html**). Additionally, training may be helpful for both the IAQ Manager and other staff. Both the EPA and commercial vendors sponsor training on *Building Air Quality* and IAQ generally. Descriptions of EPA developed training materials are located in Appendix 2. EPA Regional Headquarters IAQ coordinators can help you locate EPA-sponsored training in your area. See Appendix 3 for a listing of the EPA Regional IAQ Coordinators contact information.

Establishing a New IAQ Baseline:

Step 2: Develop an IAQ Profile of Your Building

Reference: *Building Air Quality*: Section 4, "Developing an IAQ Profile," Pages 19–29.

Purpose: To gain a comprehensive understanding of the current IAQ situation in your building, including all of the factors that could influence your building's IAQ.

The next step in the process is to document the current IAQ situation and existing operation and maintenance practices in your building. The *Building Air Quality* guide refers to this step as developing an "IAQ Profile." The IAQ Profile describes the features of your building's structure, function, and occupancy that impact IAQ. Completing the IAQ Profile gives you an understanding of the current status of air quality in your building and baseline information on the factors that may cause future problems. If you do not have the information or expertise to complete a certain part of the IAQ Profile, seek assistance from other members of your IAQ team, such as a building engineer or similarly trained professional (see *BAQ*, page 20).

The IAQ Profile focuses on: 1) identifying and reviewing records, such as blueprints and operating instructions; 2) conducting a walkthrough inspection to document information on IAQ-related Heating Ventilating and Air Conditioning (HVAC) practices and conditions, and possible pollutant sources throughout the building.

Step 2, Part One: Identify and Review Existing Records

Building Air Quality: Section 4, "Developing an IAQ Profile: Collect and Review Existing Records," Pages 21–22; also, Ventilation Worksheet, Zone/Room Record Form and Pollutant Pathway Form, Pages 175-177.

The first part of developing the IAQ Profile focuses on identifying and reviewing the documents that should

Specific Activities:

☑ Identify, review, and familiarize yourself with construction, operating and other documents including:

- "As built" blueprints and building specifications that have been up-dated to indicate current conditions,
- Up-to-date list of control system set-points and ranges for all HVAC equipment, including variable air volume (VAV) supply terminals and exhaust systems,
- Up-to-date drawings of tenant buildouts and interior building renovations,
- Information on major space use changes,
- Up-to-date information on pressure relationships (see Pollutant Pathway Form, *BAQ*, page 175),
- Up-to-date schedules and procedures for facility operations and maintenance,
- Up-to-date manufacturers' operating instructions and maintenance records for HVAC system components, and
- If available, historical complaint logs relating to air quality and comfort (see Step 8, page 18).

☑ Set up procedures to revise the above records, as needed, but particularly with any renovation/construction.

☑ Request from suppliers and keep on file Material Safety Data Sheets (MSDSs) for products used in the building (see also 29 CFR 1910.1200 Hazard Communication Standard).

☑ Determine quantity of outside air entering building (see Ventilation Worksheet, *BAQ*, page 179).

☑ Compare capacity of HVAC system with current loads to make sure there are no shortfalls in the amount of outside air provided.

Step 2, Part One: Continued

already exist at your building. These documents are critical to the development and implementation of the Action Plan. If you find that you cannot locate any of the documents listed in the "Specific Activities" text box on page 7, you should try to collect these from outside sources if at all possible. The original architects, engineers and/or equipment suppliers may be useful sources for this information. If you are unable to obtain an updated set of architectural and HVAC blueprints or the set points and ranges under which the HVAC system operates, you should create these documents either in-house or through an outside contractor. These documents are integral to efficient and effective diagnosing of IAQ problems, if they occur.

Make sure to revise the records mentioned in the text box on page 7 as needed, but particularly at the conclusion of any renovation/construction activities.

Step 2, Part Two: Conduct a Walkthrough to Assess Current IAQ Situation

Building Air Quality: Section 4, "Developing an IAQ Profile: Conduct a Walkthrough Inspection of the Building," Pages 22–29.

Conducting a building walkthrough inspection helps you acquire a good overview of occupant activities and building functions that may impact IAQ. Even if you are intimately familiar with the operations of your building, the walkthrough allows you to view your building specifically with IAQ in mind. You should consider conducting the walkthrough with other staff familiar with the building -- additional perspectives may help you notice problem indicators otherwise missed. If you can not conduct the walkthrough with others, at least talk to other building staff both for help in identifying potential or existing problems as well as to gain feedback on the cause(s) and solution(s) to any problem(s) you identified.

Building Walkthrough Specific Activities:

- ☑ Conduct a whole-building walkthrough inspection.
- ☑ During the walkthrough, complete a pollutant/source inventory (see Pollutant/Source Inventory Form, *Building Air Quality*, pages 213-219).
- ☑ Look for IAQ problem indicators including odors, dirty or unsanitary conditions, visible fungal growth, mold or mildew, moisture in inappropriate locations, staining or discoloration of building materials, smoke damage, presence of toxic substances, poorly-maintained filters, potential for soil gas entry, unusual noises from equipment, leaks, uneven temperatures, overcrowding, personal air cleaning devices (ion generators, ozone generators or portable filtration units), personal fans and blocked or re-directed vents/diffusers.
- ☑ Take notes on a floor plan during the walkthrough and identify potential or existing problems indicating a need for either close monitoring or corrective action.
- ☑ Inspect HVAC condition and operations.
  - List components that need to be repaired, adjusted, cleaned or replaced.
  - Record actual control settings and operating schedules for each air handling unit.
- ☑ Check to see if significant sources of contamination are directly exhausted to the outside or can be moved close to an exhaust fan.

As you walk through your building, pay careful attention to indicators of possible IAQ problems. Seemingly inconsequential items could indicate IAQ problems. For example, discolored walls could indicate mold growth, while fans on occupants' desks could indicate inadequate ventilation or cooling. A more detailed list of IAQ problem indicators is included in the "Specific Activities" text box on this page.

Step 3: Address Existing and Potential IAQ Problems

Reference: *Building Air Quality*: Section 6, "Diagnosing IAQ Problems," Pages 45–79, Section 7, "Mitigating IAQ Problems," Pages 81–104.

Purpose: To fix or mitigate all existing or potential IAQ problems in order to protect the health, comfort, and productivity of a building's occupants and staff.

Using the information from the IAQ Profile, the IAQ Manager can identify current practices or conditions that could, or already do, adversely affect indoor air quality. By correcting these conditions and modifying these practices, you will establish a good IAQ baseline in your building.

Some IAQ problems are easy to diagnose, especially using the knowledge gained from the *Building Air Quality* guide and your building's IAQ Profile. In other cases, IAQ problems can be very complex, and diagnosing them may require outside assistance by IAQ professionals. Such expert resources should be identified before problems occur so that you are ready to solve a problem quickly if one should occur.

The flow chart on page 45 of the *Building Air Quality* guide shows the general scheme of conducting an IAQ investigation. It is impossible to prescribe one specific set of steps that will work for every IAQ problem. Instead, you should read the *Building Air Quality* guide, Section 6, for a general understanding of the many tools available for an IAQ investigation.

General Strategies to Correct IAQ Problems:

- ☑ Identify sources, then remove or reduce the source, seal or cover the source, or modify the environment.
- ☑ Improve ventilation in order to provide outside air to occupants and to dilute and/or exhaust pollutants.
- ☑ Improve air filtration to clean air from outside and inside the building.
- ☑ Control occupant exposure to pollutants through administrative approaches such as scheduling contaminant-producing activities during unoccupied periods.

Some IAQ problems are related to uncontrolled pollutant sources. One pollutant source of concern is biological growth. In order to control or prevent biological contamination, you must address the two elements essential for biological growth: nutrients and moisture. You can greatly decrease the likelihood of problems associated with biological growth by preventing, or promptly cleaning up, the buildup of dirt, dust and standing water, and by controlling relative humidity (keep relative humidity between 30 and 60%; see American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 55-1992 or latest publication; see Appendix 3 for ASHRAE contact information).

Other problems can be linked to deficiencies in the HVAC system, such as uncalibrated controls, inoperable equipment, or inadequate maintenance and operating practices (look for indicators such as torn or overloaded filters, dirty or damaged insulation and inoperable dampers/baffles). These deficiencies can also make it difficult to provide an adequate volume of outside air to flush contaminants from the building.

Step 3: Continued

After diagnosing specific IAQ problems, seek solutions that will correct or mitigate the problems and prevent them from recurring. General strategies to correct IAQ problems include:

- Identifying sources, then removing or reducing the source, sealing or covering the source, or modifying the environment;
- Improving ventilation to provide outside air to occupants and to dilute and/or exhaust pollutants;
- Improving air filtration to clean air from outside and inside the building; and
- Controlling occupant exposure through administrative approaches such as scheduling contaminant-producing activities during unoccupied periods.

Refer to the *Building Air Quality* guide, Section 6 and 7, pages 45-104, for a more complete discussion of strategies to correct IAQ problems. In some cases, full mitigation of a problem may require working with others outside of the building. For example, if the source of a problem is idling trucks in an adjacent alley, you may need to educate the drivers about the hazards of unnecessary idling. As you take action to address the issues identified in Step 2, keep records of your progress so you can refer to them later if further questions or related issues arise.

BAQ Action Plan

Maintaining and Improving Your IAQ Baseline:

Step 4: Educate Building Personnel About IAQ Management

Reference: *Building Air Quality*: Section 5, "Managing Buildings for Good IAQ: Assign Responsibilities/Train Staff," Pages 33–34.

Purpose: To identify and educate staff about IAQ issues so that they can become valuable agents in identifying, preventing, and solving IAQ problems.

Specific Steps:

- ☑ Identify in-house and contractor personnel whose functions could affect IAQ.
- ☑ Provide training and information for in-house personnel and contractors.
- ☑ Develop a flow of information from building staff to IAQ Manager.

It is important that building staff are knowledgeable about IAQ issues. Typically, facility personnel are not trained to think about IAQ issues as they go about their work, even though their perspective could be helpful. For example, staff may observe unsanitary conditions, blocked vents, evidence of leaks in tenant spaces or other indicators of potential IAQ problems and fail to recognize their importance. Educating building personnel about IAQ issues will allow them to recognize potential problems before they cause harm.

The Action Plan asks that you identify in-house and contractor personnel whose functions could affect IAQ, such as pest control contractors, housekeeping personnel and HVAC maintenance staff. It is important to create, keep, and update a list of these personnel so the information can be used and referred to in the future. The list will also help to identify who might benefit from IAQ training. Another way to help identify which staff could benefit from IAQ training is by completing Steps 2 and 3, *Establishing an IAQ Baseline*. The findings from Steps 2 and 3 will help the IAQ Manager identify areas where improvement can be accomplished through additional training or information.

The Action Plan asks that you provide IAQ training or information to building staff and contractor personnel whose responsibilities could affect your building's IAQ. Both informal, in-house information sharing and formal training courses are beneficial. You can choose the methods that are most effective: structured training courses and materials, distribution of IAQ information and fact sheets to staff, informal discussions, seminars, or self-training materials. However, it is required through the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (29 CFR 1910.1200) that you inform and train staff who use hazardous chemicals, even if infrequently, about the health effects of the chemicals they use in their duties, how to read, understand and follow label instructions and Material Safety Data Sheets, and what to do in case of emergency.

Descriptions of EPA developed training courses are located in Appendix 2. The EPA Regional IAQ coordinators can help you locate EPA-sponsored training courses in your area. Please refer to Appendix 3 for a listing of the EPA Regional IAQ Coordinators contact information.

Step 5: Develop and Implement a Plan for Facility Operations and Maintenance

Reference: *Building Air Quality*: Section 5, "Managing Buildings for Good IAQ: Facility Operation and Maintenance," Pages 34–36; also Appendix B, "HVAC Systems and Indoor Air Quality," Pages 123–137.

Purpose: To maintain and operate your building to prevent IAQ problems.

IAQ can be affected both by the quality of maintenance and by the materials and procedures used in operating and maintaining the building's components. Keeping IAQ in mind when you plan for operations and maintenance is a good way to prevent IAQ problems.

1) HVAC Operations: A building operations schedule is basically a daily/weekly/monthly schedule of each individual HVAC component compiled together in a comprehensive whole. This allows for cross comparison of different components schedules and synchronization. It is imperative that your operations schedule reflect the actual use of your building, ensuring that the HVAC system is providing ventilation during all periods of significant occupancy. It is important that this schedule be written and comprehensive, so that there is a "one-stop" reference that is complete, easily updated and accessible to all who need it.

HVAC Operations Specific Steps:

- ☑ Operate the HVAC system during periods of significant activity and confirm that written operating schedules reflect this.
- ☑ Operate the HVAC system with as much outside air as practical prior to occupants' arrival.
  - Economizers and energy recovery systems, when properly used, can reduce energy costs while increasing outdoor air supply.

In general, ventilate your building with the maximum volume of outside air that is practical, taking into account your HVAC system capacity and current climatic conditions–refer to the latest publication of ASHRAE Standard 62 for the current 'best practice' in HVAC system design (see Appendix 3 for ASHRAE contact information).

Economizer operations can reduce cooling costs while increasing outdoor air ventilation. However, malfunctioning economizer controls have been known to cause IAQ problems, such as dampers stuck in the closed position. Make sure economizer controls are frequently maintained and recalibrated, especially if you use enthalpy controls (ones that take into account both temperature and relative humidity). Exercise care to ensure that on/off set points are adjusted to avoid indoor relative humidity problems. Enthalpy controls can give the highest energy savings as well as help prevent the potential for excess moisture to be delivered into the building, which is especially important in areas of the U.S. where humid conditions are prevalent. However, the ASHRAE Standard 90.1 *User's Manual* recommends that drybulb (temperature only) controllers be used in dry and mild climates (e.g., southwestern U.S.) because they are less expensive, require less maintenance and are more reliable than enthalpy sensors (ASHRAE/IES Standard 90.1-1989, *User's Manual*; see Appendix 3 for ASHRAE contact information).

Energy recovery systems may make it feasible to increase outdoor air ventilation rates during temperature extremes. The hotter the outside air, the more energy heat recovery saves. The same is true on the heating side, but only to a point – make sure not to freeze the moisture in the outgoing air stream. Any time you would normally use 100% outside air, turn the heat recovery off.

Finally, before building occupants arrive for the day, schedule the introduction of as much outside air as practical to dilute pollutants that may have accumulated over night. Flushing can also provide pre-cooling, or night cooling – another way to contain energy costs. However, make sure that the amount of outside air used is consistent with the proper function of the HVAC equipment (e.g., coil freezing during extreme cold) and maintaining recommended relative humidity levels (30-60%, ASHRAE Standard 55-1992 or latest publication; see Appendix 3 for ASHRAE contact information).

2) Housekeeping: Inadequate housekeeping can cause IAQ problems – keep your building clean. Also, cleaning materials themselves may be pollutant sources that produce odors and emit a variety of chemicals. Select cleaning methods that are effective for the given need. Read product labels and Material Safety Data Sheets (MSDS) on all cleaning products in use in your building. Remember, your housekeeping staff will be the most highly exposed to the chemicals in your cleaning products. Buy products with the least adverse impact on human health.

Housekeeping Specific Steps:

- ☑ Prepare and follow written housekeeping procedures that detail the proper use, storage and purchase of cleaning materials.
- ☑ Be aware of the housekeeping products and equipment used in your building, particularly those that are potential irritants or have other IAQ impacts.
- ☑ Purchase the safest available housekeeping products that meet your cleaning needs.
- ☑ Educate housekeeping staff or contractors about proper use of cleaning materials, cleaning schedules, purchasing, materials storage and trash disposal.

It is important that the housekeeping staff, whether they are in-house staff or contractors, be trained on how your housekeeping procedures and products may affect IAQ. In fact, OSHA's Hazard Communication Standard (29 CFR 1910.1200) requires employers to explain the labels and MSDSs of all hazardous chemicals used, even infrequently, by an employee, and to train those employees in how to protect themselves from emergencies.

Other issues regarding housekeeping that are important to maintaining and improving your building's IAQ include: having *written* procedures; knowing what equipment and products are used in your building; and purchasing safer products.

Step 5: Continued

3) Preventive Maintenance: A written preventive maintenance program is an effective tool for improving IAQ. The plan should include monitoring, inspecting and cleaning HVAC components such as outside air intakes, outside air dampers, air filters, drain pans, heating and cooling coils, the interior of air handling units, fan motors and belts, air humidification, controls and cooling towers. Pages 34–36 of the *Building Air Quality* guide contain general information on maintenance activities while pages 123–137 detail specific HVAC components, their role in IAQ, and instructions for preventive maintenance.

The frequency of maintenance activities may vary from building to building. It is important that you develop a maintenance schedule based on the needs of your equipment and building. However, your schedule should ensure that all equipment is in good, sanitary condition and is operating as close to design set points as possible.

4) Unscheduled Maintenance: When unscheduled maintenance events (e.g., equipment failures) require the prolonged deactivation or modification of building HVAC equipment, maintenance personnel should be instructed to immediately notify the IAQ Manager. The IAQ Manager should review the situation carefully and provide recommendations to maintenance and administrative personnel on how to proceed without compromising the building's IAQ. The IAQ Manager should also communicate with building occupants and tenants to inform them how their air quality is being protected.

Preventive Maintenance Specific Steps:

☑ Develop and follow a preventive maintenance plan that includes maintenance schedules. Activities in the plan should include:

- Inspect outside air dampers for nearby sources of contamination,
- Ensure that air dampers are clear of obstruction and operating properly,
- Regularly replace or clean air filters,
- Clean and inspect drain pans,
- Inspect and clean heating and cooling coils,
- Inspect and clean, as warranted, the interior of air handling units,
- Inspect fan motors and belts,
- Regularly inspect and clean air humidification equipment and controls,
- Inspect, clean and treat cooling towers, and
- Inspect and clean, as needed, air distribution pathways and variable air volume (VAV) boxes.

☑ Update your maintenance plan when equipment is added, removed or replaced.

Unscheduled Maintenance Specific Steps:

☑ Immediately notify the IAQ Manager.

☑ Ensure that the building's IAQ is not compromised.

☑ Notify tenants and/or occupants how their air quality is being protected.

Step 6: Manage Processes with Potentially Significant Pollutant Sources, Including Remodeling and Renovation, Painting, Pest Control, Shipping and Receiving, and Smoking.

Reference: *Building Air Quality*: Section 5, "Managing Buildings for Good IAQ," Pages 37–41.

Purpose: To control potential contaminant sources within a building during special activities.

Indoor contaminants can be drawn in from outside or can originate within a building. If contaminant sources are not controlled, IAQ problems can arise, even if the HVAC system is well-maintained and running properly. Step 6 involves managing some of the major sources of indoor pollutants in your building, including: 1) remodeling and renovation; 2) painting; 3) pest control; 4) shipping and receiving; and 5) smoking.

Specific Steps:

☑ Request information from product suppliers on contaminant emissions.

☑ Discuss IAQ concerns with architects, engineers and contractors.

Remodeling and Renovation:

☑ Use and/or require contractors to follow the special procedures described in *Building Air Quality*, pages 40 and 99, to minimize contaminants and odors during buildouts.

Painting:

☑ Minimize exposure to paint vapors through the use of low-emitting products, scheduling or ventilation.

1) Unless remodeling and renovation are planned with IAQ in mind, these activities can create indoor air quality problems by emitting dust, odors, microorganisms and their spores, and VOCs. Take steps to prevent IAQ problems by isolating work areas. These steps include:

•Ensuring that the IAQ Manager reviews the designs and construction activities for all proposed remodeling or renovation activities prior to their initiation (see Step 7, page 17, for communication responsibility of tenants and the IAQ manager regarding remodeling projects),

•Scheduling work during periods of low occupancy,

•Isolate work areas by blocking return vents in the work area and/or installing temporary barriers,

•Pressurizing spaces that adjoin the work space in order to prevent transportation of pollutants,

•Using specialized cleaning procedures (e.g., HEPA vacuums),

•Changing filters more frequently, especially after work is completed,

•Minimizing emissions from materials processes (e.g., wet sanding dry wall), and

•Buying safer products (e.g., formaldehyde-free cabinetry).

2) Painting of interior spaces can also produce irritating or harmful vapors. Methods to prevent problems include using low VOC-emitting paint (now commercially available -- ask your product supplier), performing work during periods of low occupancy and arranging ventilation to isolate work areas.

Step 6: Continued

3) Pest Control: Pest control methods often depend on the use of pesticides, whose storage, application, and handling can have serious health effects if label instructions are not followed. Chemical pesticides must be dealt with carefully to avoid indoor air quality problems. For example, mixing of pesticides should occur either outdoors or under a mixing hood specifically designed for pesticide mixing. One way to minimize the risk of IAQ problems from pest control is Integrated Pest Management (IPM) which emphasizes the use of non-chemical pest management practices wherever practical. The EPA brochure, "Pest Control in the School Environment: Adopting Integrated Pest Management," (EPA# 735F93012) may provide useful information on IPM practices. You can obtain this document through the National Center for Environmental Publications and Information (NCEPI) by calling 1-800-490-9198.

Use Integrated Pest Management to the extent possible:

- ☑ Know what pest control products are used in your building.
- ☑ Prepare written pest contract procedures that detail the proper purchase, use, mixing, storage and disposal of pesticides according to label directions.
- ☑ Use non-chemical pest control strategies where possible.
- ☑ Purchase the safest available pest control products that meet your needs.

Shipping and Receiving:

- ☑ Take steps to prevent vehicle exhaust from entering your building.

Smoking:

- ☑ Institute a smoking policy that prohibits smoking or provides direct exhaust and adequate ventilation to areas where smoking is permitted. Refer to the latest publication of ASHRAE Standard 62 (see Appendix 3 for ASHRAE contact information) and the EPA Brochure, "What You Can Do About Secondhand Smoke."

4) Shipping and receiving areas have the potential to create indoor air quality problems regardless of the types of materials being handled. Provide adequate ventilation for activities or materials that produce odors, dust or contaminants. Also, building managers should take steps to ensure that vehicle exhaust from loading docks does not enter the building. For a typical vehicle area that is predominantly open to the atmosphere, you can prevent engine exhaust from migrating into surrounding building areas by maintaining the rooms surrounding loading docks under substantial positive pressure (relative to the vehicle areas). Alternatively, for vehicle areas that are predominantly enclosed, you could maintain the vehicle area at a substantial negative pressure (relative to the surrounding building areas). In either case, this task is made easier through the use of vestibules or air locks.

5) Environmental tobacco smoke (ETS) can be a source of irritation and is known to cause cancer. Establishing a smoking policy that protects occupants and visitors from exposure to ETS is essential to maintaining good IAQ in your building. To accomplish this, you should institute a smoking policy that prohibits smoking or restricts smoking to areas that are separately ventilated, maintained under negative pressure and directly exhausted to the outside. Refer to the latest publication of ASHRAE Standard 62 (see Appendix 3) and the EPA Brochure, "What You Can Do About Secondhand Smoke."

Maintaining cooperative relations with tenants and occupants:

Step 7: Communicate with Tenants/Occupants About Their Role in Maintaining Good IAQ

Reference: *Building Air Quality*: Section 3, "Effective Communication," Page 13-17; also, *Building Air Quality*: Section 5, "Managing Buildings for Good IAQ: Occupant Relations," Page 40.

Purpose: To open communication lines between building owners and tenants/occupants so that tenants/occupants can become part of the solution to IAQ problems.

Specific Steps:

- ☑ Inform tenants and occupants about building conditions and policies that may have a significant adverse IAQ impact.
- ☑ Notify tenants and occupants when major renovation, remodeling, maintenance or pest control activities are planned.

Early and frequent communication with occupants is important both to prevent IAQ problems from occurring and to secure their cooperation when solving existing problems. It is important for building occupants to understand that their activities can create indoor air quality problems and that their cooperation is critical for maintaining good IAQ in their building. To help educate building occupants/tenants about the effect of their actions on IAQ, the EPA has published a publication entitled, "An Office Building Occupants' Guide to Indoor Air Quality." It explains the roles and responsibilities of both building occupants and owners/managers and can be freely copied. We recommend that you make this publication available to all tenants/occupants. Contact the EPA's IAQ Information Clearinghouse or visit EPA's World Wide Web site (**www.epa.gov/iaq/pubs/occupgd.html**) to obtain a copy.

Building management is responsible for notifying building tenants, and, where applicable, building occupants, about building conditions, policies, or activities, such as unscheduled maintenance events, that may have a significant adverse IAQ impact. Building occupants and/or tenants are responsible for notifying the IAQ manager when activities are planned that could affect the building's IAQ (e.g., construction or other pollutant releasing activities) and promptly bringing unusual conditions to the attention of the IAQ manager. An example of this communication comes when tenants are planning construction, remodeling or renovation activities; the IAQ Manager should be made aware of these plans in order to review them with the whole building's IAQ in mind. Both parties should use chemicals and materials in accordance with their label instructions and MSD sheets.

Step 8: Establish Procedures for Responding to IAQ Complaints

Reference: *Building Air Quality*: Section 3, "Effective Communication: Establish a System for Responding to Complaints," Pages 13–17.

Purpose: To ensure adequate and timely response to occupant complaints and to prevent small complaints from becoming major health or comfort problems.

Occupant complaints about IAQ may be vague or specific, but they should always be taken seriously and investigated fully. In many cases, the IAQ Manager may be first alerted to potential IAQ problems by occupants. Establishing procedures for responding to and resolving complaints will ensure that all complaints are handled in a consistent and fair manner. If building occupants know that they will get a response, they will be more likely to provide prompt, helpful input about building conditions.

Examples of complaint forms, incident log forms, occupant interview forms and occupant diary forms can be found in the *Building Air Quality* guide on pages 181 through 187.

Specific Steps:

☑ Prepare and follow clear procedures for recording and responding to IAQ complaints, including:

- Logging entries into your existing work-order system,
- Collecting information from the complainant,
- Ensuring the confidentiality of information and records obtained from complainants,
- Determining the response capability of in-house staff,
- Identifying appropriate outside sources of assistance,
- Applying remedial action,
- Providing feedback to the complainant, and
- Following-up to ensure that remedial action has been effective.

☑ Inform building staff of these procedures.

☑ Inform building occupants and/or tenants of these procedures and periodically remind them how to locate responsible staff and where to obtain complaint forms.

Record keeping

One important element underlying the actions described in this guidance is the development and maintenance of a comprehensive, easy-to-use record keeping system. In fact, the Action Plan contains many activities regarding the availability and location of records. The IAQ Manager may want to designate a file cabinet, bookshelves, or notebooks to store information on the IAQ program, including steps taken to complete the Action Plan. Alternatively, the IAQ Manager may wish to develop a single list of all pertinent IAQ records and their locations. These records will be a valuable tool to help the IAQ Manager coordinate day-to-day IAQ activities as well as respond efficiently and effectively to IAQ problems. These records will also serve as documentation of program implementation.

Checklist

To assist building management in verifying implementation of the Action Plan, EPA provides a Checklist. The Checklist is designed to highlight the guidance presented in *Building Air Quality: A Guide for Building Owners and Facility Managers* and closely matches the recommendations contained in the eight steps described here in the *BAQ Action Plan.* Answering these questions will help you determine whether you have taken all of the steps EPA recommends to implement good IAQ management practices or whether additional actions should be taken to bring your building up to the level described in the guidance. As you address the issues discussed in the Checklist, keep records of your progress so you can refer to them later if questions or related issues arise.

Building Air Quality Action Plan
Verification Checklist

STEP 1: DESIGNATE AN IAQ MANAGER	For Guidance, refer to:
❑ (1) An IAQ Manager has been designated. Name: Title:	*Building Air Quality,* Page 33
❑ (2) The IAQ Manager has been educated on the contents of *Building Air Quality: A Guide for Building Owners and Facility Managers* by reading it carefully and possibly receiving training on the fundamentals of IAQ. Notes:_____	Some training courses and materials are listed in Appendix 2 of this publication, Page 28

STEP 2: DEVELOP AN IAQ PROFILE OF YOUR BUILDING	For Guidance, refer to:
1. Identify and Review Existing Records	*Building Air Quality,* Pages 19–22
❑ (3) Up-to-date manufacturers' operating instructions and maintenance records for HVAC system components have been reviewed and filed.	*Building Air Quality*, Page 21 (note-box)
❑ (4) Up-to-date schedules and procedures for facility operations and maintenance have been reviewed and filed.	*Building Air Quality*, Page 21
❑ (5) HVAC "as built" blueprints have been updated to indicate current HVAC configuration and filed.	*Building Air Quality,* Page 21
❑ (6) Drawings of tenant build-out and interior building renovations have been updated and	*Building Air Quality*, Page 21
❑ (7) Information on major space use changes (e.g., office space to kitchen or laboratory, significant increases or decreases in occupant density) has been updated and filed.	*Building Air Quality*, Page 22
❑ (8) The HVAC system was designed to deliver _____ CFM of outside air which translates into CFM of outside air per occupant.	*Building Air Quality*, Pages 8, 136, and 137
❑ (9) The HVAC system is actually delivering _____ CFM of outside air which translates into _____ CFM of outside air per occupant.	*Building Air Quality*, Pages 8, 136-7 and Ventilation Worksheet, Pages 169 and 179 (to be used in conjunction with Zone/Room Record Form, Page 177)
❑ (10) A review of occupant thermal comfort complaints and indoor temperature and relative humidity readings indicates that current peak heating and cooling loads do not exceed HVAC system capacity.	*Building Air Quality*, Page 122
❑ (11) Information on pressure relationships between areas and/or zones within the building has been examined, updated, and filed.	*Building Air Quality,* Pages 8–10 and Pollutant Pathway Record Form, Pages 169 and 175
❑ (12) The building's most recent test and balancing report has been filed. Date of report:_____	*Building Air Quality*, Pages 21 and 123
❑ (13) Material Safety Data Sheets (MSDS) for products used in the building are requested from suppliers and kept on file.	*Building Air Quality,* Pages 28, 35, and 39; 29 CFR 1910.1200 Hazardous Communication Standard, OSHA
❑ (14) Documentation of HVAC control system set points and ranges has been reviewed and	*Building Air Quality,* Pages 21 (text-box)
❑ (15) The building records (items #3-14) listed above are revised as needed, particularly at the conclusion of any renovation/construction activities.	*Building Air Quality,* Pages 21-22

Building Air Quality Action Plan
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STEP 2: DEVELOP AN IAQ PROFILE OF YOUR BUILDING (continued)	For Guidance, refer to:
2. Conduct a Walkthrough to Assess the Current IAQ Situation	
❑ (16) A building walkthrough inspection has been conducted, including both occupied areas and mechanical rooms.	*Building Air Quality,* Pages 22–29
❑ (17) During the walkthrough, a pollutant/source inventory has been completed.	*Building Air Quality*, Pollutant Source Inventory Form, Page 26, and Pages 213–219
During the walkthrough, IAQ problem indicators have been checked for and noted on a floor plan or comparable drawing, including:	*Building Air Quality,* Pages 23–25
❑ (18) • Odors	*Building Air Quality,* Pages 23–25
❑ (19) • Dirty or unsanitary conditions	"
❑ (20) • Visible fungal growth or moldy odors	"
❑ (21) • Evident moisture in inappropriate locations (e.g., moisture on walls, floors, or	"
❑ (22) • Staining or discoloration of building material(s)	"
❑ (23) • Smoke damage	"
❑ (24) • Presence of hazardous substances	*Building Air Quality*, Pages 23-25 and Chemical Inventory Form, Pages 169 and 221
❑ (25) • Potential for soil gas entry (e.g., cracks or holes in building surfaces adjacent to	*Building Air Quality*, Pages 23–25
❑ (26) • Unusual noises from light fixtures or equipment	"
❑ (27) • Poorly-maintained filters	"
❑ (28) • Uneven temperatures	"
❑ (29) • Overcrowding	"
❑ (30) • Personal air cleaners (e.g., ozone generators, portable filtration units) or fans	"
❑ (31) • Inadequate ventilation	"
❑ (32) • Inadequate exhaust air flow	"
❑ (33) • Blocked vents	"
❑ (34) • Other conditions that could impact IAQ, especially risk factors that need regular inspection to prevent IAQ problems from occurring (e.g., drain pans that do not fully drain).	"
The condition and operations of the HVAC system have been inspected, including:	*Building Air Quality,* Page 25 and HVAC Checklist - Long Form, Pages 169 and 195
❑ (35) • Components that need to be repaired, adjusted, cleaned, or replaced have been and work orders prepared.	*Building Air Quality,* Pages 23–25
❑ (36) • Actual control settings and operating schedules for each air handling unit have been recorded and filed, and checked against the design intent.	"
❑ (37) Areas with significant sources of contaminants (e.g., copy rooms, food service areas, printing/photographic areas) are provided with adequate exhaust. Other sources are moved as close to exhaust as possible.	*Building Air Quality,* Page 25
Notes: _____	

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STEP 3: ADDRESS EXISTING AND POTENTIAL IAQ PROBLEMS	For Guidance, refer to:
Identified IAQ problems have either been corrected or steps have been taken to control them, including:	*Building Air Quality,* Pages 45–108
❑ (38) • Source-related IAQ problems	*Building Air Quality,* Pages 45–108
❑ (39) • Ventilation-related IAQ problems.	*Building Air Quality,* Pages 45–108
❑ (40) Weaknesses have been identified and steps taken to prevent them from becoming	*Building Air Quality,* Pages 45–108
Notes:_____	

STEP 4: EDUCATE BUILDING PERSONNEL ABOUT IAQ MANAGEMENT	For Guidance, refer to:
❑ (41) In-house and contractor personnel whose functions could impact IAQ (e.g., housekeeping staff, maintenance contractors) have been identified.	*Building Air Quality,* Pages 23 and 32–34
❑ (42) IAQ training or information has been provided to in-house personnel and contractors -- especially regarding use of hazardous chemicals. Additional training or information is provided periodically, and plans for continual improvement have been established.	*Building Air Quality,* Pages 33–34 and 167; 29 CFR 1910.1200 Hazard Communication Standard, OSHA.
Notes:_____	

STEP 5: DEVELOP AND IMPLEMENT A PLAN FOR FACILITY OPERATIONS AND MAINTENAN	For Guidance, refer to:
1. HVAC Operations	
❑ (43) Operating schedules for HVAC equipment, ensuring that the HVAC system is operating during significant occupancy periods, have been written and are updated as needed.	*Building Air Quality* , Page 34
❑ (44) The HVAC operating schedule provides for an adequate flush of the building, with as much outside air as is feasible, prior to occupants' arrival.	*Building Air Quality* , Page 34 and ASHRAE Standard 62-1989, or latest publication (see Appendix 3, Page 30)
Notes:_____	

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STEP 5: DEVELOP AND IMPLEMENT A PLAN FOR FACILITY OPERATIONS AND MAINTENAN (continued)	For Guidance, refer to:
2. Housekeeping	
❑ (45) All housekeeping equipment and products used in the building are known to the IAQ Manager.	*Building Air Quality* , Pages 36-37
❑ (46) The products used in this building that may produce strong odors, are potential irritants, or may have other IAQ impacts have been determined and, where possible, have been replaced by products without such impacts.	See Material Safety Data Sheets
❑ (47) Housekeeping procedures that detail proper use, storage, and purchase of cleaning materials have been written and are updated as needed.	*Building Air Quality* , Pages 36-37
The housekeeping staff or contractors have been educated about the IAQ implications, appropriate use, and application of the following to improve IAQ:	*Building Air Quality* , Pages 36-37
❑ (48) • Proper cleaning methods	"
❑ (49) • Cleaning schedules	"
❑ (50) • Purchasing	"
❑ (51) • Proper materials storage and use	"
❑ (52) • Proper trash disposal.	"
3. HVAC Preventive Maintenance	
❑ (53) A preventive maintenance plan that includes equipment maintenance schedules has been written or computerized and is followed and updated as needed.	*Building Air Quality,* Pages 34, 35, 36, 43, and 121–139
A preventive maintenance plan or contract includes at least the following maintenance	*Building Air Quality* , Page 36
❑ (54) • Outside air intakes (inspected for nearby sources of contaminants)	*Building Air Quality,* Pages 124–125
❑ (55) • Air distribution dampers (cleared of obstruction and operating properly)	*Building Air Quality,* Pages 125–126
❑ (56) • Air filters (pressure drops monitored, replacement or cleaning performed regularly)	*Building Air Quality,* Pages 126–128
❑ (57) • Drain pans (inspected and cleaned to ensure proper drainage)	*Building Air Quality* , Page 128
❑ (58) • Heating and cooling coils (inspected and cleaned)	*Building Air Quality* , Page 128
❑ (59) • Interior of air handling units (inspected and cleaned, as warranted)	*Building Air Quality* , Pages 25, 26, 35,
❑ (60) • Fan motor and belts (inspected)	*Building Air Quality* , Page 130
❑ (61) • Air humidification and controls (inspected and regularly cleaned)	*Building Air Quality,* Pages 129–130
❑ (62) • Cooling tower (inspected, cleaned, and water treated according to schedule)	*Building Air Quality* , Page 135
❑ (63) • Air distribution pathways and VAV boxes (inspected and cleaned as needed).	*Building Air Quality* , Pages 25-26, 36, 123-126, and 130-133
❑ (64) The preventive maintenance plan and operations manuals are updated when equipment is added, removed, or replaced.	*Building Air Quality* , Page 35
4. Unscheduled Maintenance	
❑ (65) Procedures for unscheduled maintenance events (e.g., equipment failure) have been written and communicated to building staff. They include:	*Building Air Quality* , Page 32-35, 67
❑ (66) • Building maintenance personnel immediately tell the IAQ Manager that an maintenance event has occurred.	"
❑ (67) • Notification to occupants/tenants is provided in a timely manner, addressing how quality is being protected.	"
❑ (68) • Necessary remedial action is taken.	"
Notes:_____	

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STEP 6: MANAGE PROCESSES WITH POTENTIAL SIGNIFICANT POLLUTANT SOURCES	For Guidance, refer to:
General	
❑ (69) When new products are purchased, information on potential indoor air contaminant emissions is requested from product suppliers. *[Note: Emission information may not be readily available for many products at this time, however information that is available should be collected.]*	*Building Air Quality* , Page 37
❑ (70) When the services of architects, engineers, contractors, and other professionals are used, IAQ concerns, such as special exhaust needs, are discussed.	*Building Air Quality* , Page 40
1. Remodeling and Renovation	
❑ (71) Special procedures to minimize the generation and migration of contaminants or odors to occupied areas of the building are used (or required of contractors).	*Building Air Quality* , Pages 6,40, and 99
The special procedures used in this building are:	
❑ (72) • The IAQ Manager reviews designs and construction activities for all proposed remodeling and renovation activities prior to their initiation	*Building Air Quality* , Pages 6,40, & 99
❑ (73) • Work is scheduled during periods of minimum occupancy	"
❑ (74) • Ventilation is provided in order to isolate work areas	"
❑ (75) • Lower-emitting work processes are used (e.g., wet-sanding dry wall)	"
❑ (76) • Specialized cleaning procedures are used (e.g., use of HEPA vacuums)	"
❑ (77) • Filters are changed more frequently, especially after work is completed	"
❑ (78) • Emissions from new furnishings are minimized (e.g., buying lower-emitting products, airing out furnishings before installation, increased amount and duration of after installation)	"
❑ (79) • Ventilation and distribution equipment are protected.	"
2. Painting	
❑ (80) Occupants' exposure to paint vapors is minimized by using low-emitting products, scheduling work during periods of minimum occupancy, or increasing ventilation.	*Building Air Quality* , Pages 6,40, & 99
3. Pest Control	
❑ (81) Integrated Pest Management procedures are used to the extent possible:	
❑ (82) • The pest control products being used in the building are known.	*Building Air Quality* , Page 38
❑ (83) • Either by written procedures or contract language, it is ensured that all people who use pest control products read and follow all label directions for proper use, mixing, storage and disposal.	"
❑ (84) • Non-chemical pest control strategies are used where possible.	"
❑ (85) • The safest available pest control products that meet the building's needs are or reviewed with pest control contractor.	"
4. Shipping or Receiving	
❑ (86) Vehicle exhaust has been prevented from entering the building (including through air intakes and building openings) by installing barriers to airflow from loading dock areas (e.g., doors, curtains, etc.) and using pressurization. Notes: _____	*Building Air Quality* , Page 37

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STEP 6: MANAGE PROCESSES WITH POTENTIAL SIGNIFICANT POLLUTANT SOURCES (continued)	For Guidance, refer to:
5. Smoking	
❑ (87) A. Smoking is prohibited in all portions of this building, including tenant occupied space.	"What You Can Do About Secondhand Smoke", EPA 1993
OR	
❑ (88) B. If smoking is permitted in the building, all smoking areas are exhausted directly to the outside, are maintained under negative pressure relative to adjacent space, and are with 60 CFM per occupant of make-up air (can be supplied by transfer air).	ASHRAE Standard 62–1989 (see Appendix 3, Page 30), and "What You Do About Secondhand Smoke," EPA
Notes:_____	

STEP 7: COMMUNICATE APPROPRIATELY WITH TENANTS/OCCUPANTS ABOUT THEIR ROLE IN MAINTAINING GOOD IAQ	For Guidance, refer to:
❑ (89) Tenants or occupants are routinely informed about building conditions and policies that may impact IAQ (e.g., practices that attract insects or smoking policy clarifications).	*Building Air Quality* , Pages 14 and 40
❑ (90) Tenants or occupants are notified in advance of major renovation, remodeling, maintenance or pest control activities.	*Building Air Quality* , Page 14
Notes:_____	

STEP 8: ESTABLISH PROCEDURES FOR RESPONDING TO IAQ COMPLAINTS	For Guidance, refer to:
Clear procedures for responding to IAQ complaints have been written and are followed, including:	*Building Air Quality* , Pages 15–17
❑ (91) • Entries such as IAQ problems are logged into the existing work-order system.	"
❑ (92) • Information is collected from complainants.	"
❑ (93) • Information and records obtained from complainants are kept confidential.	"
❑ (94) • The capability of in-house staff to respond to complaints is assessed.	"
❑ (95) • Appropriate outside sources of assistance are identified.	"
❑ (96) • Feedback is provided in a timely manner to complainant.	"
❑ (97) • Remedial actions are taken.	"
❑ (98) • Remedial actions are followed-up to determine if the action has been effective.	"
❑ (99) Building staff have been informed of these procedures.	*Building Air Quality* , Page 13
❑ (100) Building occupants and/or tenants have been informed of these procedures and are periodically reminded of how to locate responsible staff and where to obtain complaint forms.	*Building Air Quality* , Page 14
Notes:_____	

Appendix 2

Training Resources

Training for IAQ Managers:

Building Air Quality: An Introduction to Building Air Quality is a four-hour introductory course on *Building Air Quality: A Guide for Building Owners and Facility Managers.* It is highly interactive, introducing the causes of indoor air quality (IAQ) problems, providing suggestions on diagnosing and mitigating IAQ problems, and showing how to prevent them from occurring in the first place. The course is specifically designed to meet the training needs of building owners and facility managers. The instructor's guide, slides and student manual can be purchased through the Department of Commerce, Technology Administration, National Technology Information Service (NTIS). The order number for the kit is AVA19188SS00, and the number for NTIS is 1-703-605-6900 (for two-day "rush" orders only, call 1-800-553-6847). The World Wide Web site for NTIS, **www.ntis.gov/ordering**, contains other ordering information, including email and FAX ordering forms and information, but you cannot order directly at their web-site. Please note that this document is not listed in their web-accessed, searchable database.

Other Available EPA Training:

Orientation to Indoor Air Quality (OIAQ) is an overview course that addresses the needs of personnel who are working to resolve indoor air pollution problems. It provides information about indoor air pollution sources and their health effects; how buildings operate; what guidelines are available to identify indoor air quality hazard levels (and their limitations) and, recommended approaches to indoor quality problem prevention, diagnosis and mitigation and prevention for residential, commercial and institutional buildings. Check with the EPA Regional IAQ coordinators (Appendix 3) to determine whether this training course is being presented in your area. The Orientation to Indoor Air Quality (OIAQ) course is available for purchase from the NTIS. The order number for the *OIAQ Instructor Kit* is AVA19276SS00. To obtain additional copies of the *OIAQ Student Manual* (in units of 10) use order number AVA19277BB00. The toll free number and World Wide Web site for the NTIS is listed above, though, again, these documents are not listed in their web-accessed database.

Basic IAQ Hands On Measurements and Diagnostics: Basic Tools for Evaluating the Indoor Air Environment is a one-day training course that provides hands-on awareness in IAQ measurements, instrumentation and the limitations of data interpretation. It is directed toward health and building professionals with little background in the design and evaluation of non-industrial ventilation systems. Check with EPA Regional IAQ coordinators (Appendix 3) to determine if this training course is being offered in your area.

Introduction to Indoor Air Quality is a two-volume home-study course produced under a cooperative agreement between the National Environmental Health Association, the U. S. Public Health Service and the U. S. Environmental Protection Agency. Its primary focus is residential indoor air quality. The course may be purchased for $47.00 through the National Environmental Health Association, 720 South Colorado Boulevard, #970 South Tower, Denver, Colorado 80246-1925. This document contains nine lessons with review questions and a final examination. Environmental Health professionals may receive continuing education credits from the National Environmental Health Association by passing the final examination with an acceptable score. The second volume contains reference data and useful tools for practical applications and problem solving.

Appendix 3

Useful Contacts

There are many sources of additional information on indoor air quality in office, homes and schools which provide guidance on healthy indoor environment. To obtain a list of available EPA publications, see www.epa.gov/iaq/pubs/index.html

The *Building Air Quality Action Plan*, *Building Air Quality: A Guide for Building Owners and Facility Managers* and *An Office Building Occupants' Guide to Indoor Air Quality*, plus many other EPA documents, may be downloaded from:

The U.S. Environmental Protection Agency Indoor Air Quality Home Page on the World Wide Web:

http://www.epa.gov/iaq

Copies of the *Building Air Quality Action Plan* and other NIOSH documents are available from:

National Institute for Occupational Safety and Health
1-800-35-NIOSH (1-800-356-4674)
Education and Information Division
Publications Dissemination
4676 Columbia Parkway
Cincinnati, OH 45226-1988
Fax Number: (513)533-8573
E-mail: pubstaft@niosdt1.em.cdc.gov

To receive other information about occupational safety and health problems, call:

1-800-35-NIOSH (1-800-356-4674)

or visit the National Institute for Occupational Safety and Health World Wide Web Home Page at:

http://www.cdc.gov/niosh

Appendix 3: continued

Useful Contacts

International Facility Management Association

IFMA is the professional association for facility management with approximately 15,500 members in 126 chapters worldwide. The organization spots trends, conducts research, provides educational programs and assists facility managers worldwide in developing strategies to manage the human, facility and real estate assets of an organization.

International Facility Management Association

1 E. Greenway Plaza, Suite 1100

Houston, TX 77046-0194

1-713-623-4362

http://www.ifma.org

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

ASHRAE/IES Standard 90.1 (1989) *Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings*; and ASHRAE 90.1 i-1993, "Addenda to ASHRAE 90.1-1989" (1993)

ASHRAE Standard 62 (1989) *Ventilation for Acceptable Indoor Air Quality*

ASHRAE Standard 55 (1992) *Thermal Environmental Conditions for Human Occupancy*

ASHRAE Guideline 1 (1989) *Guideline for the Commissioning of HVAC Systems*

Available from:

ASHRAE
(404) 636-8400
Publications Sales Department
1791 Tullie Circle NE
Atlanta, GA 30329
FAX (404) 321-5478
www.ashrae.org

Appendix 3: continued

U.S. Environmental Protection Agency Regional Offices

Region 1
Connecticut, Maine, Massachusetts,
New Hampshire, Rhode Island, Vermont

J.F. Kennedy Federal Bldg. (CPT)
Boston, MA 02203-2211
Indoor Air Contact - Mary Beth Smuts
(617)565-3232
Fax #(617)565-4940

Region 2
New York, New Jersey, Puerto Rico,
Virgin Islands

290 Broadway, 28th Floor (R2DEPDIV)
New York, NY 10007-1866
Indoor Air Contact - Larainne Koehler
(212)637-4005
Fax #(212)637-4942

Region 3
Delaware, District Of Columbia, Maryland,
Pennsylvania, Virginia, West Virginia

1650 Arch Street
Philadelphia, PA 19103-2029
Indoor Air Contacts -
Fran Dougherty
Cristina Schulingkamp
(877)352-5999
Fax #(215)566-2134

Region 4
Alabama, Florida, Georgia, Kentucky,
Mississippi, North Carolina, South Carolina,
Tennessee

61 Forsyth St, SW
Atlanta, GA 30303-3104
Indoor Air Program Manager - Henry Slack
(404)562-9143
Fax #(404)562-9095

Region 5
Illinois, Indiana, Michigan, Minnesota, Ohio,
Wisconsin

77 West Jackson Boulevard (AE-17J)
Chicago, IL 60604-3590
Indoor Air Contact - Sheila Batka
(312)886-6053
Fax # (312)353-8289

Region 6
Arkansas, Louisiana, New Mexico, Oklahoma,
Texas

1445 Ross Avenue (6PD-T)
Dallas, TX 75202-2733
Indoor Air Contact - Michael Miller
(214)665-7550
Fax #(214)665-6762

Region 7
Iowa, Kansas, Missouri, Nebraska

726 Minnesota Avenue (ART/ARBR-RAID)
Kansas City, KS 66101
Indoor Air Contact - Michael Marshall
(913)551-7604
Fax #(913)551-7065

Region 8
Colorado, Montana, North Dakota,
South Dakota, Wyoming, Utah

999 18th Street, Suite 500 (8P2-TX)
Denver, CO 80202-2466
Indoor Air Contact - Megan Williams
(303)312-6431
Fax #(303)312-6044

Region 9
Arizona, California, Guam, Hawaii, Nevada

75 Hawthorne Street (Air-6)
San Francisco, CA 94105
Indoor Air Contact - Barbara Spark
(415)744-1132
Fax #(415)744-1073

Region 10
Alaska, Idaho, Oregon, Washington

1200 Sixth Avenue (OAQ-107)
Seattle, WA 98101-9797
Indoor Air Contact - Brooke Madrone
(206)553-2589
Fax # (206)553-0110