East Carolina University

Office of Environmental Health & Safety

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Indoor Air Quality Program Guide

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1. Introduction

The quality of indoor air can greatly affect employee health, safety, comfort and productivity, which is why this program is developed by the Office of Environmental Health and Safety as a guide to improving and maintaining indoor air quality on campus. The Occupational Safety and Health Administration (OSHA) does not regulate the quality of indoor air, but does recommend good ventilation and building care to prevent and resolve indoor air problems. This guide reflects best practices as provided by agencies and organizations such as: Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), American Industrial Hygiene Association (AIHA) etc.

2. Scope

The contents of this program is intended for buildings owned and operated by East Carolina University.

3. Exclusions

Indoor air quality (IAQ) causes are sometimes confounding. For this reason, EH&S will consider a problem as IAQ-related by performing proper investigation and assessment on a case by case basis. As a rule of thumb, indoor air problems are present when air contains dust and objectionable odors, chemical contaminants, dampness or mold. Also included are the physical characteristics of the air which includes but not limited to the amount of air flow, its temperature, and humidity etc.

4. Responsibilities

The following are responsible for the successful implementation of this program:

a. Office of Environmental Health and Safety

The Office of Environmental Health and Safety shall:

i. Implement this guide in managing IAQ problems in the University, and periodically revising it to reflect best practices.

ii. Proactively identify locations or buildings with potential IAQ problems and take preventive steps in ensuring employee health and safety.

iii. Conduct IAQ investigations upon notification and recommend appropriate short and long term corrective actions.

iv. Work with Facilities Services, Prospective Health, Departments and other parties to ensure identified problems are addressed and prevented from reoccurring.

v. Document and maintain investigation reports, making same available to building occupants or representatives where such investigations were carried out.

b. Facilities Services

The University's Facilities Services shall:

i. Maintain building and building system integrity.

ii. Effectively maintain systems which malfunction affect the quality of air, such as HVAC, plumbing etc. It shall have a performance profile of building ventilation system including analyses of comfort, ventilation and sanitation.

iii. Render preventive maintenance schedules that comply with manufacturers' specification for the HVAC systems.

iv. Document preventive maintenance and repairs done on HVAC system for a minimum of three years.

v. Some important maintenance information to be documented should include those contained in Appendix A.

vi. Support the investigation process by ensuring suggestions and recommendations are implemented.

c. Departments

Affected departments or designated representatives shall:

i. Report suspected IAQ issues promptly.

ii. Report HVAC problems to Facilities Services. Discomforts created by factors such as temperature, humidity, air flow etc. should be reported as soon as possible.

iii. Report water leaks or flooding services immediately, signs of water leaks include: condensate, stained ceiling tiles, wet/damp or damaged carpet.

iv. Contact EH&S when IAQ related problems are suspected in buildings or when reported by an employee.

d. Office of Prospective Health

The Office of Prospective Health shall:

i. Conduct physical assessment of employee work-related illness which are related to IAQ problems.

ii. Conduct (through Biological safety) mold and mildew investigations and recommend corrective actions.

iii. Collaborate with EH&S in uncovering probable causes of IAQ problems. For example employee complaints, medical surveillance changes etc.

e. Employees or Occupants

Employees and building occupants shall:

i. Report unusual odor or smell to the EH&S.

ii. Report symptoms related to contaminated air.

iii. Vacate building immediately in the case of emergency IAQ problem, such that is immediately dangerous to life and health (IDLH), for example natural gas or propane leak.

iv. Support EH&S during investigations by being responsive to interviews, telephone calls, questionnaires and other enquiries.

v. Recognize how their actions and inactions contribute to the quality of air in their workplace or workspace. For example deliberately taping off air supply diffusers, prolong use of heating appliances and/or humidifiers to control heat and humidity.

vi. Consider avoiding the use of electronic cigarettes indoors which may contribute new sources of indoor air contaminants including nicotine, flavor and fragrance additives.

vii. Minimize use of fragrances, air fresheners and other scented cosmetics.

5. Procedures

i. Employees who experience respiratory problems, headaches, or other symptoms (including foul odors) relating to poor indoor air quality should contact their supervisor and EH&S.

ii. EH&S will meet the employee to conduct a facility walkthrough visual inspection of the area.

iii. If warranted, EH&S may collect measurements of temperature, relative humidity, carbon monoxide and carbon dioxide and total VOCs. Based on these results additional sampling may be necessary.

iv. Facilities Services may assist in determining if there are any HVAC or other building systems issues that may be likely associated.

v. EH&S will coordinate the resolution of any identified causes by working with concerned department(s). If warranted, a written report will be provided by EH&S.

vi. Upon resolution of the causative factor, the investigation will be closed. A follow-up inquiry may be scheduled to determine the level of improvement.

6. Program Elements

Definitions

ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers: an organization devoted to the advancement of indoor-environment-control technology in the heating, ventilation, and air conditioning (HVAC) industry.

CO: Carbon monoxide. A well-recognized, often lethal, combustion by-product.

CO_2: Carbon dioxide. Human respiratory product used as an indicator of general building ventilation efficacy and capacity.

EPA: The United States Environmental Protection Agency, a federal government agency that creates and enforce regulations for protecting human health and the environment.

Exhaust Ventilation: Mechanical removal of air from a portion of a building directly outdoors (e.g equipment, room, or general area).

Indoor Air Quality (IAQ): Indoor Air Quality (IAQ) is the air quality within and around building structures, especially as it relates to the health and comfort of building occupants (USEPA).

I-BEAM: Indoor Air Quality Building Education and Assessment Model.

IDLH: Immediately Dangerous to Life or Health, defined as the exposure to airborne contaminants that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment (NIOSH).

Investigator: Investigator as used in this guide refers to the Industrial Hygienist in the Office of Environmental Health and Safety or any other EH&S employee.

HVAC: Heating, ventilating, and air conditioning. It is the technology of indoor and vehicular environmental comfort.

Legionnaires' disease: An acute sometimes fatal respiratory disease caused by a bacterium of the genus *Legionella*, especially *L. pneumophila,* and characterized by severe pneumonia, headache, and a dry cough. The bacteria have been found in water delivery system and can survive for long periods in water system.

Natural ventilation: The movement of outdoor air into a space through intentionally provided openings, such as windows and doors, or through non-powered ventilators or by infiltration.

VOC: Volatile organic compounds are large group of carbon-based chemicals that easily evaporate at room temperature.

7. Standard and Regulations

The Occupational Safety and Health Administration (OSHA) has no specific standard regulating indoor air activities in institutional and clinical building. However, there has been growing body of published data that attempts to characterize what contaminants levels have been measured in "normal" buildings. EH&S will continue to keep track with current research and published data to make this guide reflect industry best practices.

8. Sources of IAQ problems

There are usually different factors contributing to IAQ problems. Some factors include poor ventilation (lack of outside air or faulty HVAC systems), specific contaminants like dust, particulates, airborne chemicals, biological contaminants, cleaning supplies, pesticides, sources of carbon dioxide (CO_2), carbon monoxide (CO), volatile organic compounds (VOCs) from installed equipment like 3D Desktop Printers, smoking; microbial contaminants such as mold; activities in or near a building affecting the inflow of fresh air like fumes from vehicles exhaust, nearby industries and so on.

9. IAQ Investigation

EH&S will proceed with investigation when notified by an employee, department or by proactive inspection. Employee should as well notify their supervisors or EH&S when they begin to experience signs or symptoms (like those in Appendix B) that suggest contaminated air quality.

Indoor air quality problems can sometimes be directly identified and resolved such as too hot or too cold air, while in a number of instances, they are much more difficult to diagnose and resolve. This is due to many interrelated factors some of which are physical, chemical, biological, ergonomic, environmental and even individual-related. Consequently, EH&S would consider several factors during the conduct of its investigation. Considerations will be given to buildings and maintenance, construction, ventilation systems, sources of chemical and biological contaminants and their potential health effects, concerns of building occupants among others.

After a reported or observed problem, EH&S will conduct a physical walkthrough to develop base hypotheses for conducting the investigations. Depending on the severity, the investigation will include a one-on-one interview with building occupants, as well as assessment survey contained in Appendix C, to obtain valuable information that will assist in the investigation process. The survey and interview will help to make the investigative process more focused. For example, if allergic-type reactions are reported, the investigator might pay attention initially to chemical or microbiological stressors; whereas if complaints relate primarily to stale air (stuffiness), the adequacy of the HVAC systems may be likely associated.

EH&S will also inspect internal arrangements and installations in affected buildings. Some factors to be considered under this include: ergonomic design, time and patterns of health complaints, history of IQA problems, history of incidents that may affect IAQ (like water intrusion or renovation activities), equipment installation such as large photocopiers, humidifiers etc.

Based on this initial investigation, causative factors may be identified and resolved. Otherwise, further investigation including monitoring will be performed.

10. Emergency situation

If the indoor air situation constitutes an emergency, priority will be given to evacuation of occupants from the affected building. According to EPA's I-BEAM program, the following signs and/or occurrence are considered emergency situation for indoor air problem:

i. The sudden onset of headaches, dizziness, drowsiness nausea, combustion odors.
ii. Diagnosed Legionnaires' disease or tuberculosis.
iii. Widespread breathing difficulties, chest tightness, or respiratory irritation.
iv. A natural gas or propane leak.
v. Sewage backup and "black" (sewage) water or "gray" (other non-portable) water flood; or a
vi. Hazardous material spill or release.

The EH&S office will comply with EPA recommended procedures for emergency evacuation as stated:

i. Immediately notify and seek assistance from an appropriate authority (e.g health department, Hazmat/emergency response team, fire department, gas utility etc.);
ii. Evacuate the area if needed
iii. Obtain medical assistance
iv. Inform building occupants of the problem, what is being done, and maintain clear communications; and
v. Begin remediation process

11. Identification and correction

Upon completion of investigation, identified causes will be corrected promptly to eliminate problem. Otherwise, depending on the problem and severity, a short term solution may be applied with a more comprehensive long term solution to keep safe and healthy. If the problem is an obvious HVAC deficiency, a work order will be placed to have the problem resolved. Problems related to source emission will also be resolved by directly eliminating the source (if feasible) or containing it to such extent as not to interfere with the air quality. Similarly, work-related causes such as environmental, ergonomic, job stressors, thermal discomfort, individual sensitivities (e.g Multiple Chemical Sensitivities) will be addressed and resolved accordingly.

Where problems or causes cannot be identified, further considerations will be given to unrelated factors mimicking IAQ, such as transient odor problem. If the condition persists, such that affects occupants wellbeing and productivity, further investigations will be carried out which may include external agencies and professionals.

12. End of investigation

At the end of the investigation, findings will be communicated through a written report to affected building. Report will present results of investigation, preventive measures, and recommendations to avoid future reoccurrence. A follow up plan may sometimes be carried out to track the improvement of situation.

13. Achieving a Normal Indoor Air Quality

The Office of Environmental Health and Safety will work to improve "normal" air quality in buildings owned and operated by the University by controlling sources of common complaints.

These include the following:

i. Ensuring the non-smoking policy in all buildings of the University is protected.

ii. Working with Facilities Services in making sure ventilation and HVAC systems are properly working with a well-developed and documented maintenance schedule.

iii. Making sure that ASHRAE Standard 55-2004 (Thermal Environmental Conditions for Human Occupancy) is maintained. The standard recommends that temperature be maintained in the ranges of 68^{o} to 75^{o} F in winter, and 73^{o} to 79^{o} F in summer, and the relative humidity level be kept below 60%.

iv. All renovations, remodeling or maintenance of buildings in the University must take IAQ conditions into consideration. IAQ concerns will be discussed with architects and contractors to ensure materials and procedures used minimized airborne contaminants.

v. Ensure the implementation of this program so every party know their responsibilities (as explained under the Responsibilities section) in improving the quality of air in their work environment.

14. Evaluation and update

This guide will be updated to reflect changes in regulations, standards and guidelines as established by OSHA, EPA, NIOSH etc. The Office of Environmental Health and Safety will ensure the provisions of this guide are being implemented in owned and occupied buildings of the University.

Appendix A

HVAC maintenance documentation checklist

- Date that preventive maintenance or repair was performed
- Person or company performing the work
- Documentation of:

    Checking and/or changing air filters

    Checking and/or changing belts

    Lubrication of equipment parts

    Checking the functioning of motors

    Confirming that equipment is in operating order

    Checking for microbial growth in condensate pans or standing water

Appendix B

Signs of IAQ problems

A contaminated indoor air quality present some health effects which may be acute or chronic depending on the type of agent and the duration of exposure before detection and resolution. There are however indicative signs that point to compromised indoor environment. These include irritation of the eyes, nose, throat, dizziness, headaches and fatigue (Note: *these signs are not only caused by poor IAQ, but are likely telltale signs*). While these symptoms can come by easily, others may be experienced in the long term after series of repeated exposure. Some of these effects can be systemic causing problems like respiratory disease or heart disease which in severe cases, could be fatal.

Appendix C

Instructions:

a. Please answer all questions as applicable.
b. Do not discuss your response with other staff.
c. Do not disclose your name on this survey

1. What discomforts are you experiencing that you feel are associated to the indoor environment?

2. When (month, year) did it (discomfort) first begin or occur more often than normal?

3. Are these symptoms associated with any diagnosed allergies (specific sensitivities)? Yes ☐ No ☐

4. When do these symptoms occur? (Morning ☐, afternoon ☐, evening ☐ Other___)

5. How long do the discomforts last? (Less than an hour, few hours, all day, etc.)

6. Do the discomforts occur anywhere else than your office building? Yes ☐ No ☐

7. Describe your office air if you can (in terms of odor/smell, air movement, humidity, temperature etc.)

8. Have you been diagnosed with any specific allergies? Specify:_____

9. Have you recently experienced a cold or flu or other indoor air contaminants related illness? Yes ☐ No ☐ If Yes, <u>when</u> and <u>what</u> major signs did you get?

10. Have there been any recent changes in your office environment; home environment etc. that you feel may contribute to this discomforts. Yes ☐ No ☐

    If Yes, please explain_____

11. List the symptoms that occur in the office and how long they last:

    i. ii.

    iii. iv.

12. List (if any) the symptoms that occur at home and how long they last.

    i. ii.

    iii. iv.

13. Do you experience symptoms associated with any of the following: Hay fever/pollen allergies ☐ Headache ☐ Skin allergies/rashes ☐ Cold/flu ☐ Sinus problems ☐ Other allergies_____

14. Do you wear contact lens? Yes ☐ No ☐

15. List any hobbies you regularly perform:

    i. ii.

    iii. iv.

16. What is your office/room #_____

17. How long have you worked in this office space?

18. Is any medium-large office equipment (photocopiers, large printers) near your work space? Yes ☐ No ☐

19. How satisfied are you with your work environment? _____

20. Is your job that stressful? Yes ☐ No ☐ Other _____

21. Your Sex: **M** ☐ **F** ☐

22. Any other related information you would like to provide? If yes, please do below

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Please return completed survey to EH&S investigator on site or mail form to Office of Environmental Health & Safety, 210 East 4th Street, Greenville , NC 27858 or email scanned document to safety@ecu.edu.

Appendix D

Some common IAQ problems and possible causes

(Source: AIHA: The IAQ Investigation Guide 2006)

	Complaint	Symptoms Might Include	Possible Causes	Predisposing Factors	Prevalence
1	Sick Building Syndrome	Headaches, irritation, congestion, fatigue	Not related to sources of emission or contamination	Worst when and where ventilation is inadequate	Common (a small number of cases may occur in well maintained buildings)
2	Allergic Reactions	Swelling, itching, congestion, asthma	Unsanitary conditions (excessive dust or mold growth)	Individuals usually have history of allergies (about 10-20% of population)	common
3	Hypersensitivity illness	Cough, shortness of breath, fever, chills, fatigue	Repeated exposure to microbial aerosols	Initially sensitized to high level of microbial contamination	Rare
4	Irritation	Watering, burning or dryness of eyes, nose, or throat, may be accompanied by other nonspecific symptoms such as headache, nausea, or fatigue	Excessive concentrations of volatile chemicals such as solvents or formaldehyde; might also be because of very dry air	Some people are more sensitive; tends to be worse during peak emissions or driest air	Moderate

	Carbon Monoxide Poisoning	Headache, dizziness, discoloration positive blood test, nausea, coma	Uncontrolled combustion	Cardiac conditions in more sensitive individuals	rare
5	Neurological	Headaches, tremors, loss of memory	Insecticide misuse	Some people are more sensitive	Rare
6	Infections	Diagnosed infections such as Legionnaire's or Aspergillosis	Should be related to specific contaminant in building	Previously weakened immune system	Rare
7	Comfort (thermal)	Too hot, too cold, too stuffy, too drafty	HVAC	'You can't please all of the people all of the time"	common
8	Comfort (nuisance)	No symptoms, just concern for unusual odor or other conditions	Inadequate control of source emissions or contamination	Psychosocial	Moderate
9	Psychosocial Stressors	Headaches, fatigue, muscle aches	Poor labor relations, overcrowding, unrelated concerns	Poor communication, ineffective management of change	Common
10	Mass Psychogenic Illness	Hyperventilation, fainting, skin irritation	Symptoms spread by power of suggestion	Direct contact between affected individuals	Rare
11	Ergonomic Problems	Muscle aches, fatigue, eyestrain, headaches	Uncomfortable seating, repetitive motion		Moderate
12	Lighting	Eyestrain, headaches concentration	Annoying noise interferes with		Moderate
13	Cluster of Adverse Health Effects	Any disease or health event that occurs in a building	Might be contagious hereditary, etc., might not be related to IAQ	Occupants read about IAQ in media	Rare