OSC | 11
Ohio Safety Congress & Expo

#145 – IAQ complaints and problems in office and commercial buildings

Stephen Sebesta, PE, CP, Diplomate AAEE

Wednesday, March 30, 2011
2:15 to 3:15 p.m.

Ohio | Bureau of Workers' Compensation

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INDOOR AIR QUALITY IN COMMERCIAL AND OFFICE BUILDINGS

INDOOR AIR QUALITY
IN COMMERCIAL AND OFFICE BUILDINGS

STEPHEN J. SEBESTA, Ph.D., P.E., C.P.

WEDNESDAY MARCH 30, 2011, 2:15 PM-3:15 PM

- Introduction
- Indoor Air Pollution
- Indoor Air Quality
- IAQ Health and Comfort Effects
- Sources and Types of Indoor Air Contaminants
- IAQ Regulations and Standards
- IAQ Management Plan

INDOOR AIR QUALITY
IN COMMERCIAL AND OFFICE BUILDINGS

STEPHEN J. SEBESTA, Ph.D., P.E., C.P.

WEDNESDAY MARCH 30, 2011, 2:15 PM-3:15 PM

- **IAQ Management Plan Elements**
  - **Appoint IAQ Program Manager**
  - **Compile a Building IAQ Profile**
  - **Address Existing and Potential IAQ Problems**
  - **Educate Building Personnel**
  - **Conduct O&M Activities to Minimize IAQ Problems**
  - **Respond to Indoor Air Quality Complaints**
  - **Concluding Remarks**

INDOOR AIR POLLUTION

INDOOR AIR POLLUTION

- EPA STUDIES HAVE SHOWN THAT INDOOR AIR LEVELS OF POLLUTANTS CAN BE 2 - 5 TIMES, AND OCCASIONALLY MORE THAN 100 TIMES, HIGHER THAN OUTDOOR LEVELS

- THESE LEVELS ARE OF CONCERN BECAUSE MOST PEOPLE SPEND AS MUCH AS 90% OF THEIR TIME INDOORS IN PUBLIC BUILDINGS, WORKPLACES AND HOMES

- EXPOSURE TO INDOOR AIR POLLUTANTS HAS INCREASED FROM MORE TIGHTLY SEALED BUILDINGS, REDUCED VENTILATION RATES TO SAVE ENERGY, THE USE OF SYNTHETIC BUILDING MATERIALS AND FURNISHINGS, AND THE USE OF CHEMICALLY FORMULATED PERSONAL CARE PRODUCTS, PESTICIDES, AND HOUSEHOLD CLEANERS

- IN RECENT YEARS, COMPARATIVE RISK STUDIES PERFORMED BY EPA AND ITS SCIENCE ADVISORY BOARD HAVE CONSISTENTLY RANKED INDOOR AIR POLLUTION AMONG THE TOP FIVE ENVIRONMENTAL RISKS TO PUBLIC HEALTH

HEALTH EFFECTS OF INDOOR AIR POLLUTION

- VARIOUS HEALTH EFFECTS MAY OCCUR FROM INDOOR AIR POLLUTANTS INCLUDING SOME WHICH PRODUCE DISCOMFORT OR EFFECTS THAT ARE SHORT-TERM AND TREATABLE THAT OCCUR SOON AFTER EXPOSURE AND SOME WHICH ARE SEVERELY DEBILITATING OR FATAL THAT OCCUR AFTER LONG OR REPEATED EXPOSURES

- IMMEDIATE HEALTH EFFECTS SUCH AS IRRITATION OF THE EYES, NOSE, AND THROAT, HEADACHES, DIZZINESS, AND FATIGUE OR SYMPTOMS OF SOME DISEASES, INCLUDING ASTHMA, HYPERSENSITIVITY PNEUMONITIS, AND HUMIDIFIER FEVER, MAY SHOW UP SOON AFTER EXPOSURE TO SOME INDOOR AIR POLLUTANTS

- OTHER HEALTH EFFECTS INCLUDING SOME RESPIRATORY DISEASES AND HEART DISEASE OCCUR EITHER YEARS AFTER EXPOSURE AND/OR AFTER LONG OR REPEATED PERIODS OF EXPOSURE

FACTORS AFFECTING HEALTH EFFECTS

- CERTAIN IMMEDIATE EFFECTS ARE SIMILAR TO THOSE FROM COLDS OR OTHER VIRAL DISEASES, SO IT IS OFTEN DIFFICULT TO DETERMINE IF THE SYMPTOMS ARE A RESULT OF EXPOSURE TO INDOOR AIR POLLUTION

- IN ADDITION, PEOPLE REACT VERY DIFFERENTLY TO EXPOSURE TO INDOOR AIR POLLUTANTS DEPENDING ON INDIVIDUAL SENSITIVITY OR FACTORS SUCH AS AGE AND PREEXISTING MEDICAL CONDITIONS

- SOME PEOPLE CAN BECOME SENSITIZED TO BIOLOGICAL POLLUTANTS AND SOME CHEMICAL POLLUTANTS AFTER REPEATED EXPOSURE

- IN ADDITION, THERE IS CONSIDERABLE UNCERTAINTY REGARDING THE CONCENTRATIONS OR PERIODS OF EXPOSURE THAT ARE NECESSARY TO PRODUCE SPECIFIC HEALTH PROBLEMS

INDOOR AIR QUALITY

INDOOR AIR QUALITY

- INDOOR AIR QUALITY IS NOT A SIMPLE, EASILY DEFINED OR MEASURABLE CONCEPT BECAUSE IT IS A CONSTANTLY CHANGING INTERACTION OF COMPLEX HUMAN AND ENVIRONMENTAL FACTORS THAT AFFECT THE TYPES, LEVELS, AND HEALTH EFFECTS OF POLLUTANTS AND OTHER ENVIRONMENTAL STRESSORS IN THE INDOOR ENVIRONMENT

- HOWEVER, INDOOR AIR PROBLEMS ARE PREVENTABLE AND SOLVABLE

- IT IS POSSIBLE TO MAINTAIN A HEALTHY AND COMFORTABLE INDOOR ENVIRONMENT IN ANY BUILDING BUT IT REQUIRES UNDERSTANDING AND INTEGRATING MANY COMPONENTS OF A COMPLEX SYSTEM INCLUDING HUMAN FACTORS TO PRODUCE AN ACCEPTABLE ENVIRONMENT

INDOOR AIR QUALITY

- THE TERM “INDOOR AIR QUALITY” (IAQ), INTERPRETED BROADLY, REFERS TO THE ENVIRONMENTAL CHARACTERISTICS INSIDE BUILDINGS THAT MAY AFFECT HUMAN HEALTH, COMFORT, OR WORK PERFORMANCE

INDOOR AIR QUALITY
HEALTH AND COMFORT EFFECTS

DEFINITION OF HEALTH

- A STATE OF COMPLETE PHYSICAL , MENTAL AND SOCIAL WELL BEING, AND NOT JUST THE ABSENCE OF ILLNESS OR INFIRMITY*

* WHO definition of health based on comfort as well as health proposed by OSHA as basis for IAQ standard

HEALTH AND COMFORT EFFECTS

- BUILDING RELATED ILLNESS
- SICK BUILDING SYNDROME
- ENVIRONMENTAL STRESSORS

BUILDING RELATED ILLNESS

- BUILDING RELATED ILLNESSES ARE THOSE FOR WHICH THERE IS A CLINICALLY DEFINED ILLNESS WITH A KNOWN ETIOLOGY AND INCLUDE INFECTIONS SUCH AS LEGIONELLOSIS AND HYPERSENSITITY DISEASES AND ARE OFTEN DOCUMENTED BY PHYSICAL SIGNS AND LABORATORY FINDINGS (OSHA)

BUILDING RELATED ILLNESSES (BRI)

- SENSORY IRRITATION BY KNOWN AGENTS
- RESPIRATORY ALLERGIES
-
- NOSOCOMIAL INFECTIONS
- HUMIDIFIER FEVER
- HYPERSENSITIVITY PNEUMONITIS
- LEGIONNAIRES' DISEASE
- SYMPTOMS CHARACTERISTIC OF EXPOSURE TO CHEMICAL OR BIOLOGIC SUBSTANCES (e.g. CO, formaldehyde, etc.)

FREQUENCY OF COMMON HEALTH COMPLAINTS*

COMPLAINT	BUILDINGS % OF
EYE IRRITATION	81
DRY THROAT	71
HEADACHE	67
FATIGUE	53
SINUS CONGESTION	51
SKIN IRRITATION	38
COUGH	24
DIZZINESS	22
NAUSEA	15

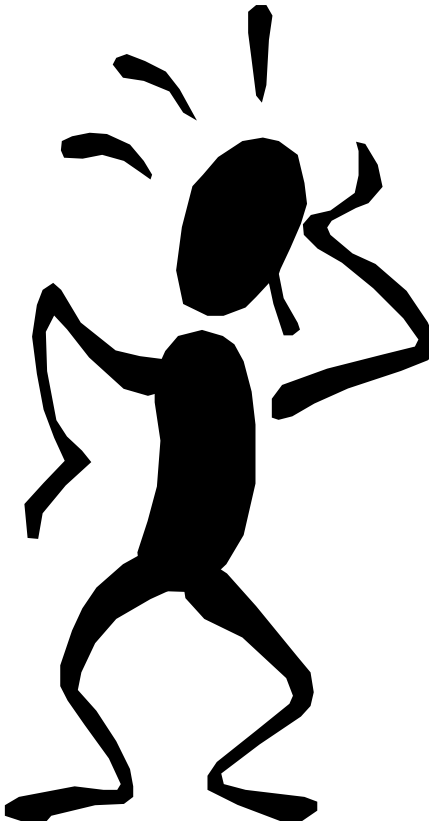
* From NIOSH

USEPA BUILDING ASSESSMENT SURVEY DATA

	(A) Minimum	(A) Mean	(A) Maximum	(B) Minimum	(B) Mean	(B) Maximum
Dry, Itching or Irritated Eyes	4.5%	26.2%	40.9%	0.0%	16.6%	40.9%
Headache	19.0%	33.0%	52.2%	0.0%	14.8%	29.4%
Sore or Dry Throat	3.4%	13.4%	26.8%	0.0%	4.2%	9.8%
Unusual Tiredness, Fatigue or Drowsiness	9.5%	24.1%	47.1%	6.6%	15.4%	32.4%
Stuffy or Runny Nose, or Sinus Congestion	4.8%	18.4%	37.0%	0.0%	9.9%	21.7%
Dry or Itchy Skin	0.0%	9.6%	23.8%	0.0%	6.1%	16.7%

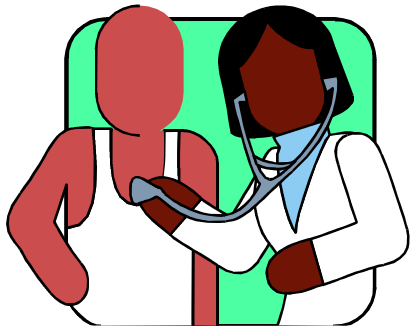
(A) Any occurrence in past 4 weeks **(B) At least 1-3 days per week in last 4 weeks**

SICK BUILDING SYNDROME (SBS)



- SICK BUILDING SYNDROME IS A CONDITION ASSOCIATED WITH COMPLAINTS OF DISCOMFORT INCLUDING HEADACHE; NAUSEA; DIZZINESS; DERMATITIS; EYE, NOSE, THROAT, AND RESPIRATORY IRRITATION; COUGHING; DIFFICULTY CONCENTRATING; SENSITIVITY TO ODORS; MUSCLE PAIN; AND FATIGUE. THE SPECIFIC CAUSES OF THE SYMPTOMS ARE OFTEN NOT KNOWN BUT SOMETIMES ARE ATTRIBUTED TO THE EFFECTS OF A COMBINATION OF SUBSTANCES OR INDIVIDUAL SUSCEPTIBILITY TO LOW CONCENTRATIONS OF CONTAMINANTS (OSHA)

SUSCEPTIBILITY FACTORS



- ALLERGIC OR ASTHMATIC INDIVIDUALS
- PERSONS WITH RESPIRATORY DISEASE
- PERSONS WHOSE IMMUNE SYSTEM IS DEPRESSED DUE TO RADIATION, CHEMOTHERAPY, OR DISEASE
- CONTACT LENS WEARERS

ASTHMA IN SCHOOLS

- Between 1980 and 1996, the prevalence of asthma increased 45 percent among children ages 5-14
- In 2002, 6.1 million children under the age of 18 were reported to currently have asthma
- Asthma is the third leading cause of hospitalization in children under 15 years of age
- Asthma is the leading cause of school absenteeism, accounting for 15 million missed days per year

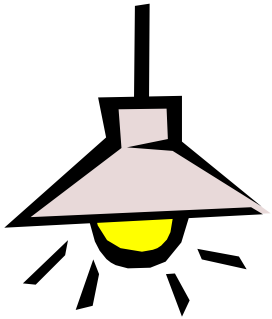
ALLERGIES AND ASTHMA

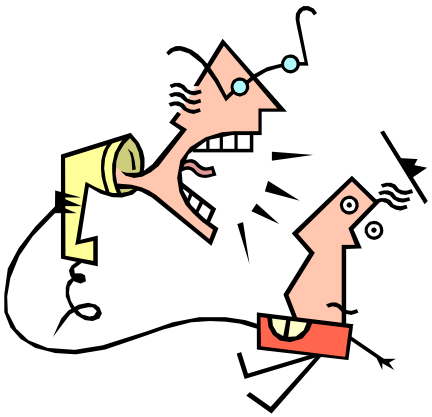
- Asthma Triggers
  - Coats
  - Stuffed animals
  - Carpet
  - Animal Dander
  - Dust Mites
  - Mold/Pollen

ENVIRONMENTAL STRESSORS

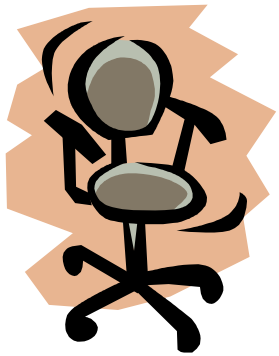
MAY PRODUCE SICK BUILDING SYNDROME SYMPTOMS

BUT ARE NOT ASSOCIATED WITH POOR AIR QUALITY





- Improper lighting
- Noise
- Vibration
- Overcrowding
- Poor Ergonomics
- Psychosocial problems (job or home stress)

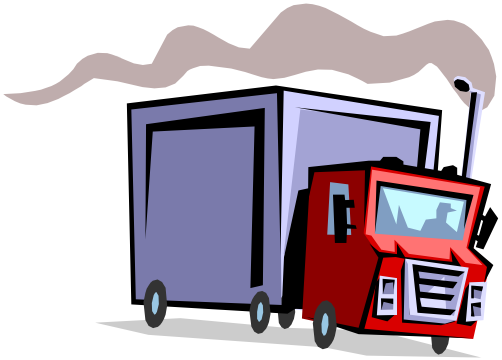


SOURCES AND TYPES OF INDOOR AIR CONTAMINANTS

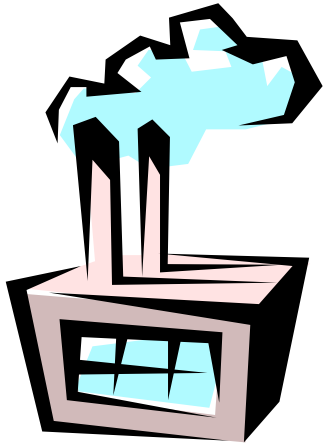
SOURCE OF OUTDOOR AIR CONTAMINANTS

- VENTILATION INTAKES
- DOORS
- BUILDING ENVELOPE
- WINDOWS
- SOIL

TYPES OF OUTDOOR AIR CONTAMINANTS



- VEHICULAR EXHAUSTS
- INDUSTRIAL EMISSIONS
- CONSTRUCTION WORK
- CHEMICAL APPLICATIONS
- OUTSIDE TOBACCO SMOKE
- MICROBIOLOGICALS
- RADON
- POLLEN

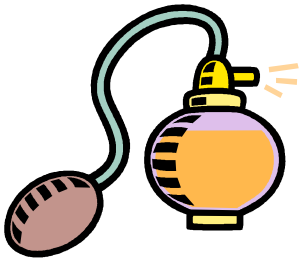


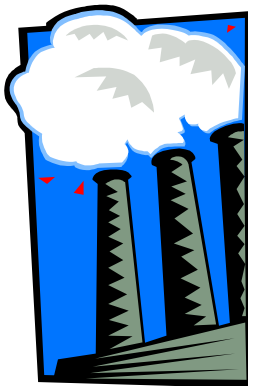
INDOOR AIR CONTAMINANTS

- TOBACCO SMOKE
- VOLATILE ORGANIC COMPOUNDS (VOC'S)
- COMBUSTION GASES
- MICROBIOLOGICALS

SOURCE OF INDOOR AIR CONTAMINANTS

- BUILDING MATERIALS
- FURNISHINGS
- APPLIANCES
- COMBUSTION SOURCES
- OFFICE EQUIPMENT
- SUPPLIES
- BIOLOGICAL ORGANISMS
- POLLUTANTS FROM OCCUPANTS
- OUTSIDE AIR AND SOIL





CONDITIONS FOR MICROBIAL CONTAMINATION

- HIGH HUMIDITY (OVER 60%)
- APPROPRIATE TEMPERATURES FOR SPECIFIC MICROBE
- APPROPRIATE GROWTH MEDIA

SOURCES OF INDOOR AIR QUALITY PROBLEMS

IN APPROXIMATELY 500 INDOOR AIR QUALITY INVESTIGATIONS IN THE LAST DECADE, THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY & HEALTH (NIOSH) FOUND THAT THE PRIMARY SOURCES OF INDOOR AIR QUALITY PROBLEMS ARE:

- INADEQUATE VENTILATION 52%
- CONTAMINATION FROM INSIDE BUILDING 16%
- CONTAMINATION FROM OUTSIDE BUILDING 10%
- MICROBIAL CONTAMINATION 5%
- CONTAMINATION FROM BUILDING FABRIC 4%
- UNKNOWN SOURCES 13%

IAQ REGULATIONS AND STANDARDS

OSHA
STATES
ASHRAE

IAQ REGULATIONS AND STANDARDS
OSHA

- Department of Labor, Occupational Safety and Health Administration (29 CFR Parts 1910, 1915, 1926, 1928) Indoor Air Quality, On December 17, 2001 (OSHA withdrew its Indoor Air Quality proposal and terminated the rulemaking proceedings, see Federal Register 66:64946)

- Although OSHA does not have IAQ standards, it does have standards about ventilation and standards on some of the specific air contaminants that can be involved in IAQ problems as well as standards in the General Duty Clause of the OSHA Regulations requiring employers to provide workers with a safe workplace that does not have any known hazards that cause or are likely to cause death or serious injury.

OSHA PEL (PERMISSIBLE EXPOSURE LIMIT)

- MOST OF THE HEALTH EFFECTS ASSOCIATED WITH SICK BUILDING SYNDROME (SBS) AND BUILDING RELATED ILLNESS (BRI) OCCUR IN INDOOR ENVIRONMENTS WHERE CONCENTRATIONS OF EXPOSURE ARE MUCH LESS THAN THE OSHA PERMISSIBLE EXPOSURE LEVELS (PELs)

- OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION "PERMISSIBLE EXPOSURE LIMIT" IS A TIME WEIGHTED AVERAGE AND IS AN ENFORCEABLE STANDARD THAT MUST NOT BE EXCEEDED DURING ANY EIGHT-HOUR WORK SHIFT OF A 40 HOUR WORK WEEK

OSHA PEL (PERMISSIBLE EXPOSURE LIMIT)

- ASHRAE* NOTES THAT AS A FIRST GUIDE, 1/10 TLV (PEL) WOULD NOT PRODUCE COMPLAINTS IN A NONINDUSTRIAL POPULATION IN RESIDENTIAL, OFFICE, SCHOOL, OR OTHER SIMILAR ENVIRONMENTS BUT THE 1/10 TLV GUIDELINE MAY NOT BE SATISFACTORY FOR SENSITIVE INDIVIDUALS

*** ASHRAE - American Society of Heating Refrigerating and Air Conditioning Engineers**

STATE IAQ REGULATIONS AND GUIDELINES

- SOME STATES SUCH AS CALIFORNIA, MINNESOTA, NEW JERSEY AND WASHINGTON HAVE ADOPTED IAQ REGULATIONS INCLUDING THE REQUIREMENT FOR WRITTEN PLANS VARIOUSLY APPLICABLE TO SCHOOLS, WORKPLACES AND PUBLIC BUILDINGS

- SOME STATES SUCH AS NEW YORK HAVE PUBLISHED IAQ GUIDELINES SIMILAR TO THE STANDARDS ADOPTED AS STATE REGULATIONS

- THESE REGULATIONS AND GUIDELINES WHICH ARE SIMILAR TO PUBLISHED USEPA GUIDELINES HAVE MANY COMMON ELEMENTS AND ARE OFTEN VIEWED AS PRESENT STATE OF THE ART STANDARDS AND BEST MANAGEMENT PRACTICES

STATE IAQ REGULATIONS AND GUIDELINES
SOME COMMON ELEMENTS

- BUILDING SITING REQUIREMENTS FOR IAQ
- DESIGN AND CONSTRUCTION IAQ CONSIDERATIONS
- OPERATION AND MAINTENANCE PROCEDURES FOR IAQ
- CONTROLLING IAQ CONTAMINANTS
- IAQ MANAGEMENT PLANS
- IAQ CHECKLISTS
- IAQ COMPLAINT PROCEDURES

IAQ REGULATIONS AND STANDARDS
STATES

THE FOLLOWING STATES HAVE INDOOR AIR REGULATIONS:

- CALIFORNIA (non-industrial workplaces)
  http://www.cdph.ca.gov/programs/IAQ/Pages/default.aspx

- MINNESOTA (K-12 schools)
  http://www.health.state.mn.us/divs/eh/indoorair/schools/index.html

- NEW JERSEY (buildings occupied by public employees)
  http://www.state.nj.us/health/peosh/documents/iaqstd.pdf

- WASHINGTON (workplaces)
  http://www.doh.wa.gov/ehp/ts/IAQ/schooliaqbmp.pdf

GUIDELINES (SELECTED)
ILLINOIS DEPARTMENT OF PUBLIC HEALTH

PARAMETER	IDPH	ASHRAE	OSHA PEL
Humidity	20% - 60%	30% - 60%	N/A
Temperature	68 – 75 (winter) 73 – 79 (summer)	68 – 75 (winter) 73 – 79 (summer)	N/A
Carbon Dioxide	1,000 ppm <800 ppm (preferred)	1,000 ppm	5,000 ppm
Carbon Monoxide	9 ppm	50 ppm	25 ppm
Hydrogen Sulfide	0.01 ppm	N/A	10 ppm
Ozone	0.08 ppm	N/A	0.1 ppm
Particulates	0.15 mg/m^3 (PM10)	N/A	15 mg/m^3 (tot) 5 mg/m3 (resp)
Formaldehyde	0.1 ppm (office) 0.03 (home)	N/A	0.75
Nitrogen Dioxide	0.05 ppm	N/A	5 ppm

ASHRAE STANDARDS

ANSI/ASHRAE Standard 62-2001
(Including ANSI/ASHRAE Addenda listed in Appendix H)

ASHRAE STANDARD

Ventilation for Acceptable Indoor Air Quality

See Appendix H for approval dates by the ASHRAE Board of Directors and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines are given at the back of this document and may be obtained in electronic form from ASHRAE's Internet Home Page, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in U.S. and Canada).

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ANSI

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 Tullie Circle, NE • Atlanta, GA 30329

- ASHRAE, *Ventilation for Acceptable Indoor Air Quality* (ASHRAE 62-2001)

- ASHRAE, *Thermal Environmental Conditions for Human Occupancy* (ASHRAE 55-2004)

ASHRAE STANDARD 55-2004

THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY

The purpose of this standard is to specify the combinations of indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space

ASHRAE STANDARD 62-2001

ACCEPTABLE INDOOR AIR QUALITY: **AIR IN WHICH THERE ARE NO KNOWN CONTAMINANTS AT HARMFUL CONCENTRATIONS AS DETERMINED BY COGNIZANT AUTHORITIES AND WITH WHICH A SUBSTANTIAL MAJORITY (80% OR MORE) OF THE PEOPLE EXPOSED DO NOT EXPRESS DISSATISFACTION.**

VENTILATION SYSTEMS ARE DESIGNED PRIMARILY TO REMOVE OCCUPANT GENERATED CONTAMINANTS SUCH AS BODY ODOR OR OTHER CONTAMINANTS CHARACTERIZED BY CARBON DIOXIDE CONCENTRATIONS*

***These types of ventilation systems are not designed to dilute multiple point sources of contaminants that are typically found in non-industrial workplaces**

IAQ MANAGEMENT PLAN

IAQ MANAGEMENT PLAN ELEMENTS

1. DESIGNATE AN IAQ MANAGER
2. DEVELOP AN IAQ PROFILE FOR EACH BUILDING
3. ADDRESS EXISTING AND POTENTIAL IAQ PROBLEMS
4. EDUCATE BUILDING PERSONNEL ABOUT IAQ
5. DEVELOP AND IMPLEMENT A PLAN FOR BUILDING OPERATION AND MAINTENANCE
6. MANAGE PROCESSES WITH POTENTIALLY SIGNIFICANT POLLUTANT SOURCES
7. COMMUNICATE WITH TENANTS AND OCCUPANTS ABOUT THEIR ROLE IN MAINTAINING GOOD IAQ
8. ESTABLISH PROCEDURES FOR RESPONDING TO IAQ COMPLAINTS

IAQ MANAGEMENT PLAN

IAQ PROGRAM MANAGER

IAQ MANAGEMENT, IAQ PROGRAM MANAGER
DESIGNATED PERSON, QUALIFICATIONS

- THE PERSON SELECTED COULD BE THE FACILITY MANAGER, THE BUILDING OPERATING ENGINEER, THE HEALTH AND SAFETY DIRECTOR, OR THE EMPLOYEE-RELATIONS MANAGER AND SHOULD BE GIVEN SUFFICIENT AUTHORITY TO MAKE DECISIONS AND IMPLEMENT IMPROVEMENTS

- THE IAQ PROGRAM MANAGER WILL SERVE AS A "TEAM LEADER" BUT SHOULD 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

IAQ MANAGEMENT, IAQ MANAGER DESIGNATED PERSON RESPONSIBILITIES

- ASSIST IN PREPARING THE IAQ MANAGEMENT PLAN
- OVERSEE PREVENTIVE MAINTENANCE PROGRAMS, AND MAINTAIN REQUIRED RECORDS IN ORDER TO ENSURE COMPLIANCE WITH THE IAQ MANAGEMENT PLAN
- MAKE ROUTINE VISUAL INSPECTIONS
- RECEIVE EMPLOYEE CONCERNS/COMPLAINTS ABOUT INDOOR AIR QUALITY AND CONDUCT INITIAL INVESTIGATIONS
- FACILITATE REPAIRS OR FURTHER INVESTIGATION AS NECESSARY
- MAINTAIN REQUIRED RECORDS, AND PERIODICALLY UPDATE THE WRITTEN PROGRAM

IAQ MANAGEMENT PLAN

BUILDING PROFILE

IAQ MANAGEMENT PLAN, BLDG. PROFILE

- BUILDING DESCRIPTION & FUNCTION
- NARRATIVE DESCRIPTION OF FACILITY BUILDING SYSTEMS
- SINGLE LINE SCHEMATICS OR AS-BUILT DRAWINGS SHOWING MAJOR EQUIPMENT & AREAS THAT THEY SERVE
- DAILY OPERATION & MANAGEMENT PROCEDURES
- BUILDING DESCRIPTION & FUNCTION
- WRITTEN PREVENTIVE MAINTENANCE PROGRAM FOR BUILDING SYSTEMS
- CHECKLIST FOR VISUAL INSPECTION OF BUILDING SYSTEMS

IAQ MANAGEMENT PLAN, IAQ PROFILE
PAGE 1 OF 3

- AMBIENT OUTDOOR AIR QUALITY DATA (DIVISION OF AIR POLLUTION)
- OHIO MECHANICAL CODE IAQ REQUIREMENTS
- TEMPERATURE AND HUMIDITY MEASUREMENTS
- CARBON DIOXIDE MEASUREMENTS (QUARTERLY)
- AIR DISTRIBUTION DATA (DIFFUSERS, RETURNS, VAV SETTINGS, ETC.)

IAQ MANAGEMENT PLAN, IAQ PROFILE
PAGE 2 OF 3

- OUTDOOR AIR INTAKE DATA (DAMPERS, SIZE, SETTINGS, ETC.)
- STATIONARY CONTAMINATION SOURCES (CHEMICALS, KITCHENS, BATHROOMS, WELDING, ETC.)
- HVAC SYSTEM DATA (CONDENSATE PANS, CLEANING, CONTROLS, HUMIDIFIERS, ETC.)
- COOLING TOWERS
- IAQ COMPLAINT DATA (SYMPTOMS, COMPLAINTS, ETC.)

IAQ MANAGEMENT PLAN, IAQ PROFILE
PAGE 3 OF 3 (ADDITIONAL DOCUMENTS)

- AS-BUILT CONSTRUCTION DOCUMENTS
- HVAC SYSTEM COMMISSIONING REPORTS
- TESTING, ADJUSTING & BALANCING REPORTS
- OPERATIONS & MAINTENANCE MANUALS
- WATER TREATMENT LOGS
- OPERATOR TRAINING MATERIALS

CARBON DIOXIDE MONITORING, IAQ PROFILE
PAGE 1 OF 2

- AT LEAST EVERY THREE MONTHS TO DETECT SEASONAL CHANGES
- AFTER ADJUSTMENTS HAVE BEEN MADE TO THE HVAC SYSTEM
- ANY TIME THERE IS REASON TO BELIEVE THAT AIR QUALITY HAS DETERIORATED
- MEASURE LATE IN MORNING (11:00 AM) AND LATE IN THE AFTERNOON BEFORE WORKERS LEAVE FOR HOME (3:30 PM)

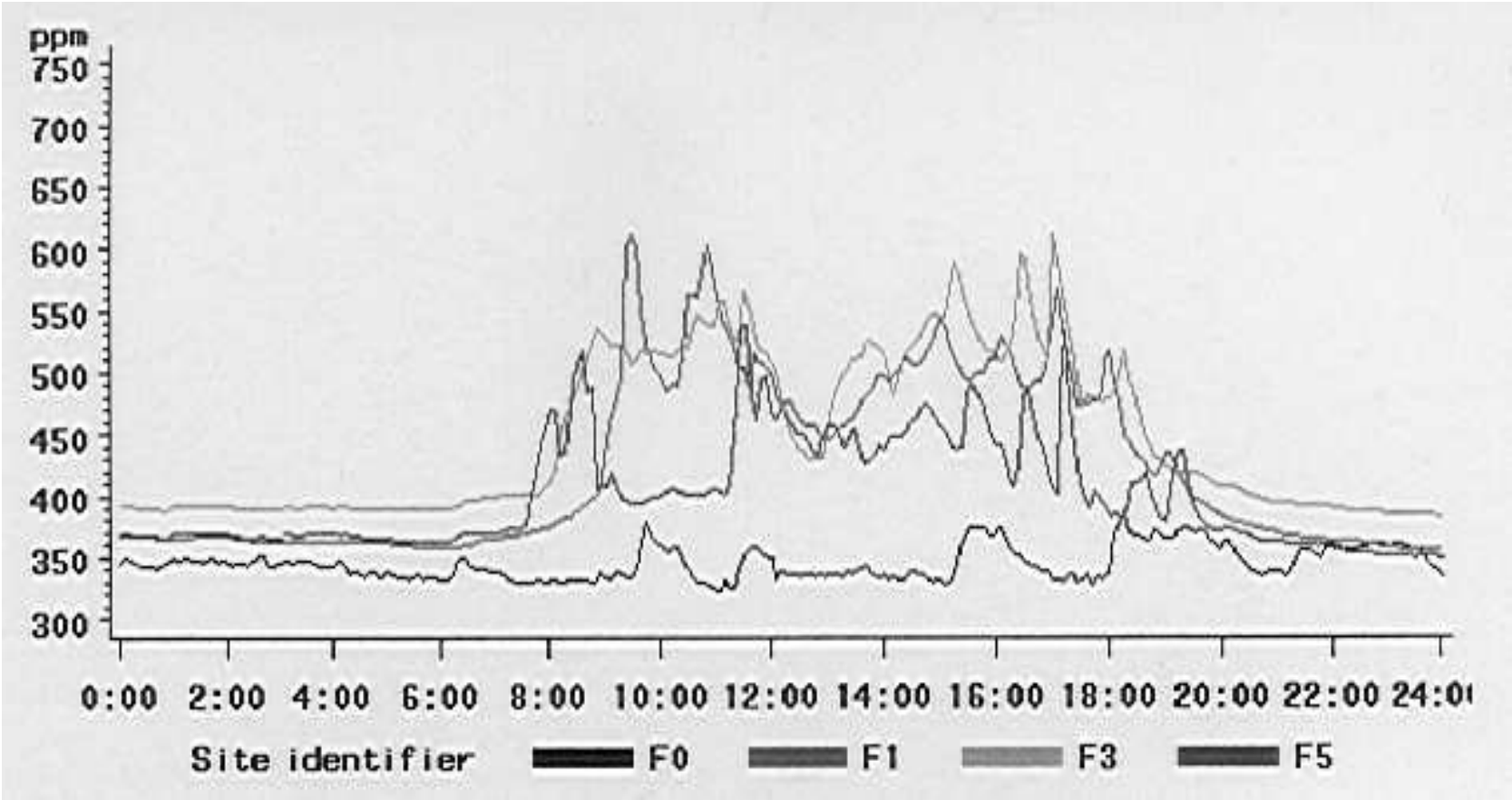
CARBON DIOXIDE MONITORING, IAQ PROFILE
PAGE 2 OF 2

- CONDUCT THE SAMPLING AT A HEIGHT OF BETWEEN 3 AND 5 FEET ABOVE FLOOR (BREATHING ZONE) AT LEAST TWO FEET FROM ANY EXHALED AIR OR OTHER SOURCES OF CARBON DIOXIDE

- SELECT NORMALLY OCCUPIED AREAS WHERE VENTILATION MIXING IS POOR

- MEASURE CARBON DIOXIDE IN OUTSIDE AIR (300 - 500 PPM) FOR COMPARISON WITH INDOOR LEVELS

CONTINUOUS CARBON DIOXIDE MEASUREMENTS
WELL VENTILATED ROOMS



FO=Outside Air

IAQ MANAGEMENT PLAN

ADDRESS EXISTING
AND POTENTIAL IAQ PROBLEMS

IAQ MANAGEMENT PLAN
ADDRESS EXISTING AND POTENTIAL PROBLEMS

- PREVENT AND ELIMINATE MOISTURE CONDITIONS AND MOLD
- MANAGE ASBESTOS
- OPERATE AND MAINTAIN HVAC AND OTHER BUILDING SYSTEMS IN ACCORDANCE WITH RECOMMENDED PROCEDURES
- ENFORCE TOBACCO USE POLICIES
- CONTROL CLEANING AND MAINTENANCE MATERIALS
- CONTROL DUST
- UTILIZE AND STORE SUPPLIES TO MINIMIZE POTENTIAL EXPOSURES TO HAZARDOUS MATERIALS OR ALLERGENS
- USE INTEGRATED PEST MANAGEMENT
- INSTALL PONT SOURCE CONTROLS AND LOCAL EXHAUST VENTILATION WHERE REQUIRED
- SCHEDULE RENOVATION AND MAINTENANCE OPERATIONS TO MINIMIZE OCCUPANT EXPOSURES TO DUST, NOISE AND EMISSIONS

IAQ MANAGEMENT PLAN

EDUCATE BUILDING PERSONNEL

IAQ MANAGEMENT PLAN, EDUCATION

- CONTENTS OF IAQ MANAGEMENT PLAN INCLUDING COMPLAINT, EVALUATION & ILLNESS INFORMATION
- MAINTENANCE OF ADEQUATE VENTILATION DURING CLEANING & MAINTENANCE OPERATIONS
- USE OF MSDS SHEETS
- USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)
- MAINTENANCE OF VENTILATION DURING USE AND/OR DISPOSAL OF CHEMICALS & OTHER AGENTS

IAQ MANAGEMENT PLAN, EDUCATION

- 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

IAQ MANAGEMENT PLAN

OPERATIONS AND MAINTENANCE

IAQ MANAGEMENT PLAN, O&M

- ASSURE THAT INSPECTIONS & MAINTENANCE ARE PERFORMED UNDER SUPERVISION OF DESIGNATED PERSON

- PROVIDE REQUIRED OUTSIDE AIR VENTILATION RATE BASED ON ACTUAL OCCUPANCY & REQUIRED BY BUILDING CODE, MECHANICAL CODE, OR VENTILATION CODE APPLICABLE AT THE TIME THE FACILITY WAS CONSTRUCTED, RENOVATED, OR REMODELED, WHICHEVER IS MOST RECENT

- MAINTAIN COMPONENTS OF NATURAL VENTILATION SYSTEM IN OPERABLE CONDITION INCLUDING WINDOWS, DOORS, VENTS, STACKS, & OTHER PORTALS DESIGNED FOR NATURAL VENTILATION

- OPERATE HVAC SYSTEM DURING ALL WORK SHIFTS EXCEPT DURING EMERGENCY REPAIRS OR SCHEDULED MAINTENANCE

IAQ MANAGEMENT PLAN, O&M

- ASSURE THAT MECHANICAL ROOMS, NON-DUCTED AIR PLENUMS OR CHASES THAT TRANSPORT AIR ARE CLEAN AND FREE OF AIRBORNE HAZARDS
- IMPLEMENT THE USE OF GENERAL OR LOCAL EXHAUST VENTILATION WHERE HOUSEKEEPING OR MAINTENANCE ACTIVITIES PRODUCE HAZARDOUS EXPOSURES TO EMPLOYEES IN OTHER AREAS

IAQ MANAGEMENT PROGRAM, O&M

- CONDUCT PROGRAMMED INSPECTIONS & MAINTENANCE
- ESTABLISH A WRITTEN RECORD OF BUILDING SYSTEMS INSPECTIONS & MAINTENANCE
- EVALUATE THE NEED TO ALTER BUILDING SYSTEMS TO MEET MINIMUM REQUIREMENTS
- TAKE SUCH REMEDIAL MEASURES AS IAQ EVALUATION INDICATES TO BE NECESSARY
- PROVIDE EMPLOYEES WITH APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT

IAQ MANAGEMENT PLAN

INDOOR AIR QUALITY COMPLAINTS

INDOOR AIR QUALITY COMPLAINTS

- MOST COMPLAINTS ABOUT THE QUALITY OF INDOOR AIR ARISE FROM EMPLOYEES WHO WORK IN NON-INDUSTRIAL ENVIRONMENTS
- HAZARDOUS EXPOSURES IN THESE WORK ENVIRONMENTS ARE OFTEN DIFFICULT TO EVALUATE
- APPROACHES USING TRADITIONAL INDUSTRIAL HYGIENE SAMPLING TECHNIQUES USUALLY DEMONSTRATE COMPLIANCE WITH OSHA PERMISSIBLE EXPOSURE LIMITS (PELS) DESPITE THE PERSISTENCE OF IAQ COMPLAINTS FROM THE BUILDING OCCUPANTS

IAQ MANAGEMENT PLAN, EVALUATING COMPLAINTS

- PROVIDE COMPLAINANTS AND POTENTIALLY AFFECTED EMPLOYEES WITH AN IAQ QUESTIONNAIRE
- CONDUCT A WALKTHROUGH INSPECTION OF THE PROBLEM AREA TO IDENTIFY POSSIBLE SOURCES OF CHEMICAL CONTAMINATION, MICROBIAL GROWTH, EXCESSIVE DUST ACCUMULATION AND POTENTIAL VENTILATION PROBLEMS
- CONDUCT INITIAL MONITORING INCLUDING MONITORING FOR CARBON DIOXIDE LEVELS, TEMPERATURE AND HUMIDITY AND INVESTIGATE HVAC SYSTEM OPERATION FOR MEASURED VALUES OUTSIDE NORMAL SYSTEM RANGE
- CONDUCT ADDITIONAL CHEMICAL OR MICROBIAL MONITORING AS DEEMED NECESSARY BASED ON THE FINDINGS DURING THE WALKTHROUGH INSPECTION

QUESTIONNAIRE RESPONSE EVALUATION

RESPONSE	No. of positive responses	% of positive responses
Satisfactory air quality	0/6	0
Too Cold	4/6	67
Too Hot	4/6	67
Lack of air circulation	5/6	83
Stuffy feeling	6/6	100
Noticeable odors	6/6	100
Dust in air	6/6	100
Disturbing noises	0/6	0
Other	5/6	83
Irritation of eye, nose, throat	4/6	67
Dry Throat, mucous membranes	4/6	67
Dry skin	2/6	33
Redness of skin	0/6	0
Headache	6/6	100

IAQ INVESTIGATIONS, INITIAL MONITORING

CONSTITUENT	DESIRED RANGE	STANDARD
Carbon Dioxide	**<1000 ppm**	ASHRAE*
Temperature	**68° -76° F**	ASHRAE*
Humidity	**20% - 60%**	ASHRAE*

***ASHRAE is the American Society of Heating, Refrigerating and Air-Conditioning Engineers**

IAQ INVESTIGATIONS

FURTHER INVESTIGATION REQUIRED IF:

- COMPLAINTS INVOLVE SUDDEN OR SEVERE INCIDENTS OF HEADACHE, NAUSEA, DIZZINESS OR LETHARGY AND CARBON MONOXIDE POISONING IS SUSPECTED
- COMPLAINTS OF SEVERE OR WIDESPREAD REPORTS OF FEVER, CHILLS AND FATIGUE, OR COUGH AND SHORTNESS OF BREATH OR A PHYSICIAN DIAGNOSED DISEASE (e.g. LEGIONNAIRES DISEASE, HISTOPLASMOSIS, ETC.) OR SYMPTOMS CONSISTENT WITH EXPOSURE TO AIRBORNE MICROORGANISMS
- COMPLAINTS OF WHEEZING OR OTHER INDICATIONS WHERE CHEMICALS ARE PRESENT THAT MIGHT AGGRAVATE ASTHMA
- COMPLAINTS OF SIGNIFICANT MOLD GROWTH OR ODORS

EMPLOYEE COMPLAINT RECORDS

- NATURE OF ILLNESS OR SYMPTOMS REPORTED
- NUMBER OF EMPLOYEES AFFECTED
- DATE OF EMPLOYEE COMPLAINT
- REMEDIAL ACTION

THANKS FOR YOUR INTEREST & ATTENTION

- Stephen J. Sebesta, Ph.D., P.E., C.P.
- Patricia S. Jammal, M.S.

USEFUL RESOURCES

- ASHRAE, *Ventilation for Acceptable Indoor Air Quality* (ASHRAE 62-2001)
- ASHRAE*, Thermal Environmental Conditions for Human Occupancy* (ASHRAE 55-2004)
- USEPA, *An Office Building Occupant's Guide to Indoor Air Quality (*EPA-402-K-97-003) w HTTP://www.epa.gov/iaq/pdfs/occupants_guide.pdf
- Consumer Product Safety Commission, American Medical Association, Environmental Protection Agency, *Indoor Air Pollution: Introduction for Health Professionals,* CPSC Document #455 http://www.cpsc.gov/cpscpub/pubs/455.html

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