



## INDOOR AIR QUALITY REVIEW- 20080908

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\*Additions or Corrections Solicited! Send these via email to Dr. James R. Tucker. Email: jim@emssales.net

1. IAQ – temperature, humidity, ventilation and concentration of chemical & biological contaminants
2. Background
  3. Americans spend 90% of time indoors
  4. IAQ 2-5 Times contaminants than Outdoors
  5. IAQ consistently in top 4 concerns
6. Poor Air Quality
  7. Reduced Ventilation
  8. Building Materials & Furnishings
  9. Deferred Maintenance
  10. Pesticides, cleaners, office machines, personal care
  11. Microbial Contamination
  12. Outdoor sources (auto exhaust)
  13. Soil Gases (e.g. Radon)
  14. Occupants
15. HVAC Problems
  16. Insufficient Outside Air Supply
  17. Broken or Disconnected Controls
  18. Dirty filters
  19. Microbial growth on HVAC components
  20. Improper Operation
  21. Occupants and IAQ
    22. Bacteria & Viruses
    23. Disabling or Blocking HVAC Registers
    24. Personal Care Products
    25. Pets in School Classrooms
    26. ETS (Environmental Tobacco Smoke)
27. IAQ Health Effects
  28. SICK BUILDING SYNDROME (SBS)
    29. Persistent set of symptoms >20% of occupants
    30. Cause(s) not recognizable
    31. Complaints/symptoms relieved after exiting
32. BUILDING RELATED ILLNESS
  33. Clinically recognized disease
  34. Exposure to indoor air pollutants
  35. Recognizable causes
36. Symptoms SICK BUILDING SYNDROME (SBS)
  37. Eye, nose, or throat irritation
  38. Headaches
  39. Fatigue

40. Reduced mentation
41. Irritability
42. BUILDING RELATED ILLNESS (BRI)
  43. PONTIAC FEVER - LEGIONELLA spp.
  44. LEGIONNAIRE'S DISEASE
  45. HYPERSENSITIVITY PNEUMONITIS
  46. HUMIDIFIER FEVER
  47. ASTHMA
  48. ALLERGY
  49. RESPIRATORY DISEASE
  50. CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)
51. INDOOR AIR CONTAMINANT TYPES
  52. COMBUSTION PRODUCTS
  53. VOLATILE CHEMICALS & MIXTURES
  54. RESPIRABLE PARTICULATES
    55. ASBESTOS
    56. CHRYSOTILE, AMOSITE, CROCIDOLITE
    57. FIBERGLASS
    58. INORGANIC DUSTS (MINERAL)
    59. METALLIC DUSTS – LEAD
    60. ORGANIC DUSTS
    61. PAPER DUSTS
    62. POLLEN
    63. BIOLOGICS & BIOAEROSOLS
    64. MOLDS & FUNGI, BACTERIA
    65. PROTOZOA, VIRUSES
    66. RADIONUCLIDES
    67. RADON & PROGENY
  68. SOURCES
    69. COMBUSTION PRODUCTS
    70. KEROSENE HEATERS
    71. LOADING DOCKS / TRAFFIC
    72. WOOD & GAS STOVES
    73. NEARBY TRAFFIC
    74. VOLATILE CHEMICALS & MIXTURES
    75. ADHESIVES & CAULKING
    76. CARPETING & DRAPERY
    77. FLOOR & WALL COVERINGS
    78. PARTICLE BOARD
    79. DRY CLEANING
    80. PAINTS, VARNISHES AND STAINS
    81. UPHOLSTERY
    82. WINDOW & FLOOR CLEANERS
    83. OFFICE EQUIPMENT
    84. COPIERS, PRINTERS, SHREDDERS
    85. ELECTRIC SWITCHES & MOTORS
    86. RESPIRABLE PARTICULATES
    87. ENVIRON. TOBACCO SMOKE (ETS)
    88. CONSTRUCTION DEBRIS
    89. OUTDOOR AIR
    90. PLANTS & PLANT PARTS
    91. BIOLOGICS & BIOAEROSOLS

- 92. HVAC SYSTEMS
- 93. COOLING TOWERS
- 94. HUMANS/ANIMALS
- 95. STAGNANT WATER RESERVOIRS
- 96. HUMIDIFIERS
- 97. WATER/MOISTURE DAMAGED MATERIALS
- 98. *Pollutant, Pathways and Driving Forces*
- 99. *IAQ Organizations*
  - 100. IAQA – Indoor Air Quality Association
  - 101. IESO – Indoor Environmental Standards Organization
  - 102. AIHA – American Industrial Hygiene Association
  - 103. ACGIH – American Congress of Governmental Industrial Hygienists
  - 104. IICRC – Institute of Inspection, Cleaning and Restoration
- 105. IAQ Regulations & Resources
  - 106. Federal
  - 107. Health Canada
  - 108. Melina-Bill
  - 109. EPA
  - 110. OSHA
  - 111. NYC, TX, CA
  - 112. Hong Kong Standard
- 113. *Bottom Line On Regulations*
  - 114. There is no scientific evidence to support the assertion that ONLY susceptible individuals are at risk from mold exposure and no safe or unsafe levels (e.g. Permissible Exposure Limits) established.
  - 115. There is sufficient information to justify remediating mold contamination to ensure the risk to occupant health is minimized.
- 116. *Sampling Methods*
  - 117. Viable
  - 118. Swab
  - 119. Air – Anderson Type Impactors, Impingers
  - 120. Non-Viable
  - 121. Bulk
  - 122. Dust Filter
  - 123. Tape Lift
  - 124. Spore Traps – Micro-5, Air-O-Cel, Burkard, Allergenco, Cyclax
- 125. *Viable Methods*
  - 126. Swab – IESO Method 1120
  - 127. Surface Sampling
  - 128. Viable
  - 129. Impactor – IESO Method 1220
  - 130. Andersen type – directly onto Agar Plates
  - 131. MEA (Malt Extract), DG-18 (DichloroGlycerol), PDA (Potato Dextrose)
  - 132. Air Flow Vacuum Pump = 28.3 liters/minute
  - 133. Impingers – Liquid Spore Traps
- 134. *Non-Viable Methods*
  - 135. Bulk, Dust Filter, 25 & 37 mm MCE Filters
  - 136. Tape Lift – IESO Method 1110
  - 137. Tape, Microscope Slides, Slide Holders
  - 138. *Spore Traps*
  - 139. High Flow Models – 1-10 minutes@15-20LPM
    - 140. Allergenco, Allergenco-D, Cyclax, Cyclax-d
  - 141. Low Flow Models (5 minutes@5 LPM = 25 L)

- 142. Micro-5
- 143. *Instruments*
  - 144. Moisture Meters
    - 145. Pin = Penetrating or Non-Penetrating
  - 146. Borescopes, Manometers, IAQ Chemical Monitors
  - 147. Particle Counters, InfraRed Cameras
  - 148. Pumps, Cassettes, Impactors, Accessories
- 149. *Sampling Plan ACGIH Recommends*
  - 150. At least one, preferably three sampling locations
    - 151. High Exposure, Low Exposure, Outdoor
  - 152. Bioaerosol Sources ID during Walkthrough
  - 153. Zones of differences in concentration
  - 154. Occupants with highest and lowest reactions
- 155. *Analysis Techniques*
  - 156. Direct Observation Observation
  - 157. Viable & Microscopic Observation
    - 158. Culture 25 C or 37 C
  - 159. PCR – Polymerase Chain Reaction
- 160. *Fungal Properties*
  - 161. Hyphae & Mycelium
  - 162. Fruiting Bodies – “Sporulation” - Spores
  - 163. Hyaline (Colorless) to Darkly Pigmented
  - 164. Segmented (Sections)
  - 165. Smooth to Rough, Pores, and/or Culpus
- 166. *Sample Analysis Costs - National Average - Published*
  - 167. Viable = \$47, Tape = \$34, Bulk = \$34, Impact=\$40
  - 168. Same Day = Double
  - 169. Holiday/Weekend = Triple
- 170. *Mold Growth Substrate & Water Activity*
  - 171. Textiles - *Trichoderma & Chaetomium*
  - 172. Ceiling Tiles - *Alternaria & Epicoccum, Chaetomium & Stachybotrys*
  - 173. Vinyl Wall Paper, Cardboard & Drywall - *Penicillium & Aspergillus, Cladosporium & Stachybotrys*
  - 174. Fish Tanks & High Moisture Levels - *Trichoderma*
- 175. *Indicator Fungal Species*
  - 176. "Bioaerosols, Fungi and Mycotoxins: Health Effects, Assessment, Prevention and Control", Edited by Johanning, E., Boyd Printing, Albany, New York
  - 177. *Acremonium* spp.
  - 178. *Aspergillus* spp, *A. fumigatus*, *A. niger*, *A. ustus*, *A. versicolor*
  - 179. *Chaetomium* spp.
  - 180. *Paecilomyces variotii*
  - 181. *Penicillium* spp, *P. brevicompactum*, *P. variable*, *P. aurantiogriseum* complex,
  - 182. *Phoma* spp.
  - 183. *Stachybotrys chartarum*
  - 184. *Trichoderma* spp.
  - 185. *T. Harzianum*, *T. viride*.
- 186. *Data Analysis (Gasp, Choke) Statistics*
  - 187. Indoor/Outdoor Ratios
  - 188. Agreement Ratio
  - 189. Chi-Squared Ratio
  - 190. Friedman – Chi-Squared Test
  - 191. Spearman Rank Correlation
  - 192. Wilcoxon Test
  - 193. Typical Outdoor Ranges (?)