

## RESEARCH HIGHLIGHT

### Indoor Air Quality (IAQ) Regulations, Standards, and Guidelines

#### INTRODUCTION

Since the 1970's indoor air quality in residences, schools, office buildings, and commercial facilities has been a growing area of awareness and concern. Federal and Provincial Government Departments and Agencies have published building codes, occupational safety and health regulations, and environmental standards and guidelines to improve the indoor environment and well-being of Canadians at home, in school, and at work.

CMHC has joined and supported the Healthy Indoors Partnership (HIP), a not-for-profit organization composed of government, industry, academic, private, and public sector representatives. HIP's mission is to facilitate multi-sectoral collaboration and partnerships to create and maintain healthier indoor environments in Canada. Through a series of publications, programs, workshops, public forums and a web site, HIP has fostered changes and increased awareness in healthy indoor environments.

Listed below is an annotated selection of IAQ Regulations, Standards, and Guidelines that HIP's Guidelines and Best Practices Committee has assembled. In addition to listing relevant documents on *IAQ*, there are sections on *Water Damage Restoration and Mould Documents*, and *IAQ and Mould Books*. Where possible, web addresses have also been provided. The list represents current legislation, state-of-the art research and technology, best practice, and an established 'standard of care' that building developers, owners, managers, architects, engineers, and the public at large should be aware of.

#### IAQ Regulations [R], Standards [S] and Guidelines [G]

##### IAQ

**Canada Labour Code**, Part II, Occupational Health and Safety Regulations, Division III, HVAC Systems, 2000. [R]

<http://www.hrsdc.gc.ca/asp/gateway.asp?hr=/en/lp/lo/fil/part2/cohsregs/r20102.shtml&hs=oxs>

These regulations apply to building owners, managers and occupants under Federal jurisdiction and stipulate that the HVAC system shall meet current ASHRAE design requirements. Record keeping and instructions for the operation, inspection, testing, calibration, cleaning and maintenance are to be developed and implemented by qualified, trained personnel. Procedures must be developed "for investigating situations in which the health or safety of an employee in the work place is or may be endangered by air quality."

**Canadian Centre for Occupational Health and Safety (CCOHS)**

<http://www.ccohs.ca/oshanswers/information/govt.html>

This center provides services for web information, MSDS database, training courses, publications and inquiries. Federal and Provincial jurisdictions ('Canadian Government Departments Responsible for OH&S'), and regulatory information are listed. Information on hazardous substances, diseases, disorders, and injuries is provided. Noted publications include, "Indoor Air Quality Health and Safety Guide", 1998, and "Mould in the Workplace", 2004.

**Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices**, American Conference of Governmental Industrial Hygienists (ACGIH), Cincinnati OH. [R]

<http://www.acgih.org>

TLV exposure guidelines are provided for control of potential workplace health hazards based on information from industrial experience and human and animal studies. The 8-hour 'time-weighted average' (TWA), 15-minute 'short-term exposure limit' (STEL), carcinogenicity category, and 'critical effect(s)' are listed for a variety of chemicals. Federal and Provincial regulations use these TLVs with different acronyms as the term TLV is ®.

**Thermal Environmental Conditions for Human Occupancy, ASHRAE Standard 55-2004**, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta, GA. [S]

<http://www.ashrae.org>

The purpose of the standard is to specify the combinations of indoor thermal environmental factors, such as air temperature, radiant temperature, air speed, and humidity, and personal factors such as metabolic rate and clothing insulation, that will produce an environment acceptable to a majority (80%) of the occupants within the space. The Standard is intended for use in design, commissioning, and testing of buildings and HVAC systems and can be applied for residential, commercial, and institutional facilities as well as other occupied spaces such as transportation vehicles.

ASHRAE Standards are now under "continuous maintenance" and revisions are incorporated and published within an established timeframe.

**Criteria for Human Exposure to Humidity in Occupied Buildings**, Sterling,E.M., Arundel,A, Sterling,T.D, 1985, ASHRAE Transactions, Vol. 91, Part 1.

Based on groundbreaking 1983 research for Health Canada on the relationship between moisture and microbial growth in indoor environments this peer reviewed paper continues to be cited as the seminal reference upon which Health Canada, Workplace Regulations, ASHRAE Design Guidance and North American moisture and IAQ Standards, guidelines and regulations are based. The paper provides an extensively

references graph identifying an optimal zone of relative humidity for human health and comfort and to minimize indoor microbial growth. The optimal humidity zone recommended is 40-60%RH.

**Ventilation for Acceptable Indoor Air Quality, ASHRAE Standard 62-2004**, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta, GA. [S]

<http://www.ashrae.org>

The purpose of this standard is to specify minimum ventilation rates and indoor air quality that will be acceptable to occupants and are intended to minimize the potential for adverse health effects. Acceptable IAQ is defined as “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.” Two procedures can be used to achieve acceptable air quality; the Ventilation Rate Procedure, which prescribes outdoor air quality and a ventilation rate for various facilities (and occupancies), and the Indoor Air Quality Procedure where exposure guidelines of selected contaminants are provided.

ASHRAE Standards are now under “continuous maintenance”, additions and revisions are added in addenda. Standard 62-2004 has incorporated 30 addenda dealing with natural ventilation, combustion air and exhaust, construction and ventilation system start-up, O&M, filtration systems, criteria for HVAC system insulation materials, etc.

**Indoor Air Quality in Office Buildings: A Technical Guide**, A Report of the Federal-Provincial Advisory Committee on Environmental and Occupational Health, Health Canada, 1995. [G]

[http://www.hc-sc.gc.ca/ewh-semt/pubs/air/office\\_building-immeubles\\_bureaux/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/air/office_building-immeubles_bureaux/index_e.html)

This document is a guideline for conducting IAQ investigations and assessments in office buildings. Factors and sources affecting IAQ, a communication strategy, and an assessment protocol are described. Exposure criteria for comfort are addressed for individual parameters and pollutants, and a checklist, measurement methods and equipment, and strategy for remediation is provided for; thermal comfort, ventilation, the HVAC system, air motion, CO, formaldehyde, particulates, VOCs, and microbials.

**Guideline for Managing Indoor Air Quality in Office Buildings**, Z204-94, Canadian Standards Association, Rexdale, ON. 1994. [G]

[http://www.csa-intl.org/onlinestore/ISO\\_Search\\_Results.asp?query=Z204-94&x=5&y=10](http://www.csa-intl.org/onlinestore/ISO_Search_Results.asp?query=Z204-94&x=5&y=10)

This consensus document defines responsibilities for good building design, management and operation. Other sections address material selection, pollution control and HVAC system design, commissioning, operation, maintenance for by system component.

**Exposure Guidelines for Residential Indoor Air Quality**, A Report of the Federal-Provincial Advisory Committee on Environmental and Occupational Health, Health Canada, 1987. [G]

[http://www.hc-sc.gc.ca/hecs-sesc/air\\_quality/pdf/tr-156.pdf](http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/tr-156.pdf)

Pollutant sources, indicators of IAQ, and exposure guidelines for selected contaminants, including carbon dioxide, water vapour, carbon monoxide, aldehydes, nitrogen dioxide, ozone, particulate matter, sulphur dioxide, formaldehyde, and lead are provided.

**Tools For Schools**, Indoor Air Quality Working Group, Federal/Provincial/Territorial Committee on Environmental and Occupational Health (CEOH), Indoor Environments Division, Health Canada, 2003. [G]

[http://www.hc-sc.gc.ca/hecs-sesc/air\\_quality/publications/tools\\_school/toc.htm](http://www.hc-sc.gc.ca/hecs-sesc/air_quality/publications/tools_school/toc.htm)

The kit provides background information on IAQ and pollution control strategies, references to additional sources and information, and specific structured checklists intended to educate and direct uses in the collection and interpretation of information. The 11 checklists include; Administration, Health, Air Handling, Classroom, Relocatable Classroom, Building Maintenance, Custodial, Food Service, Waste Management, Renovation and Repair, and Design/Build/Lease-Back Facilities.

**Natural Resources Canada (NRCAN)** [S]

<http://oe.nrcan.gc.ca/r2000> (R-2000 Standard)

<http://oe.nrcan.gc.ca/r-2000/english/public/summ05.cfm?Text=N> (R-2000 Pick List)

The R-2000 Standard for low-rise, detached, semi-detached, and row houses provides technical requirements and measures for the efficient use of energy, improved IAQ, and better environmental responsibility in the construction and operation of a house. Topics covered are building envelope requirements (insulation, airtightness, window performance), mechanical systems (heating and cooling appliances, ventilation, water heaters, and fireplaces).

A R-2000 Indoor Air Quality and Environmental Features Pick-List recommends design, construction, and material selection features (moisture control, drainage, slab depressurization, framing, wall/floor/insulation/finishing materials, and filter performance).

**Residential Mechanical Ventilation Systems.** CAN-CSA-F326-M91, Canadian Standards Association, Etobicoke, ON. [S]  
<http://www.csa-international.org>

The purpose of this standard is to define the requirements for performance, installation and application, and performance verification of mechanical ventilation systems. This Standard applies to systems that are capable of providing minimum controlled rates of ventilation air to the habitable spaces of those single-family dwellings that

- (a) fall within the Scope of Part 9 of the National Building Code of Canada; and
- (b) are self-contained with respect to heating, ventilation, and air conditioning.

**The Spillage Test - Method to Determine the Potential for Pressure-Induced Spillage from Vented, Fuel-Fired, Space Heating Appliances, Water Heaters and Fireplaces** CAN/CGSB 51.71-2005, Canadian General Standards Board, Gatineau, QC. [S]  
<http://www.pwgsc.gc.ca/cgsb/home/index-e.html>

This standard provides a test method for determining whether the depressurization of a dwelling unit by air-moving devices is sufficient to affect the ability of vented fuel-burning appliances and their venting systems to exhaust some or all of their combustion products to the outdoors.

This standard applies to dwelling units (detached, semi-detached and row housing (The standard applies to row housing that is ground accessible and equipped with self-contained ventilation and venting systems.)) equipped with both fuel-burning appliances whose products of combustion are intended to be vented to the outdoors and air exhaust devices expelling air to the outdoors or air-moving devices moving air within the dwelling unit.

The standard establishes specific conditions of test and describes the pressure-measuring apparatus and the procedures for measuring the resultant depressurization. Included is a list of depressurization limits for specified fuel-burning appliances and their venting systems. These limits are used to assess whether the level of depressurization measured is likely to result in the spillage of combustion products within the dwelling unit.

The testing and evaluation of a dwelling unit against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

**Canadian Mortgage and Housing Corporation (CMHC)**  
<http://www.cmhc-schl.gc.ca>

CMHC has published research, technical, and how-to documents for building designers, developers, specialists, consultants, and homeowners on home design, construction, and materials and appliance selection for good IAQ. Their aim to promote healthy housing covers issues on home building and renovation, reducing chemical contaminants, moisture control, water-damage restoration and mould remediation (Clean-Up Procedures for Mold in Houses, 2004), accommodating persons with asthma and those with environmental sensitivities (Building Materials for the Environmentally Hypersensitive, 1997), insulation (UFFI), soil gas (radon), combustion gas, fans, filters, and HRVs.

**Public Works and Government Services Canada (PWGSC)**

<http://pwgsc.gc.ca/realproperty/text/publications-e.html>

PWGSC has published IAQ documents dealing with improving the indoor environment, building commissioning, use of ozone generators, and water damage restoration and microbial remediation guidelines.

**Health Canada (HC)**

[http://www.hc-sc.gc.ca/ewh-semt/pubs/air/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/air/index_e.html)

The Environmental and Workplace Health Unit offers information and advice on common environmental factors that affect human health; air, noise, soil and water pollution, climate change, occupational health and safety, pest control and radiation. Air quality topics range from a description of pollutants and diseases, research, risk assessment, and regulations development. Notable publications on IAQ and mould are noted in this document, namely, Exposure Guidelines for Residential IAQ, Tools for Schools, IAQ in Office Buildings: A Technical Guide, Fungal Contamination in Public Buildings: A Guide to Recognition and Management, and Fungal Contamination in Public Buildings: Health Effects and Investigative Methods.

**British Columbia Workers' Compensation Board**

<http://indoorair.healthandsafetycentre.org/s/Home.asp>

<http://regulation.healthandsafetycentre.org/s/Part4.asp?ReportID=18006&hilit>

<http://regulation.healthandsafetycentre.org/s/GuidelinePart4.asp#SectionNumber:G4.79>

Work Safe BC, Health and Safety Centre, has published information, guidelines, and web sites on IAQ by Introduction, Factors Affecting IAQ, Control of IAQ, Regulations and Guidelines, and Resources.

Occupational Health and Safety Regulation, Part 4, General Conditions, 4.70, Indoor Air Quality, addresses HVAC system design and operation, distribution and balancing, ventilation and exhaust intakes, preventive maintenance, investigation, and temperature and humidity. General Conditions, 4.8, Environmental Tobacco Smoke, addresses control

of exposure in the workplace and designated smoking areas. Guidelines, Part 4, G4.79, “Moulds and indoor air quality” discusses conditions for mould growth, recognition and evaluation, control measures, growth in the ventilation system, and provides a guide for removal. Guidelines G4.81-4.83 deal with environmental tobacco smoke (ETS).

There is also a resource guide, “Indoor Air Quality: A Guide for Building Owners, Managers and Occupants.”

<http://www.worksafebc.com/publications>

### **U.S. Environmental Protection Agency**

<http://www.epa.gov/iaq>

The EPA “IAQ Topics” home page lists an alphabetical subject index from A to Z listing 82 topics. Included subjects can be categorized by Molds and Moisture, Asthma, Secondhand Smoke, Radon, IAQ Tools for Schools, IAQ Design Tools for Schools, IAQ in Homes, IAQ in Large Buildings, Partnership for Clean Indoor Air, Homeland Security and Indoor Environments, and Interagency Committee on IAQ.

**U.S. National Institute of Occupational Safety and Health (NIOSH) and Centre for Disease Control (CDC)**

<http://www.cdc.gov/niosh/homepage.html>

<http://www.cdc.gov/niosh/topics/indoorenv/>

The CDC/NIOSH home page lists sections on Industries and Occupations, Hazards and Exposures, Diseases and Injuries, Chemicals, Safety and Prevention, Emergency Preparedness and Response, and Data and Statistics. Notable publications are, “Pocket Guide to Chemical Hazards” and “Manual of Analytical Methods”.

The NIOSH Indoor Environmental Quality Topic Page provides a focused, organized guide to resources that will help employers, employees, building managers, and others to address concerns about work-related indoor environmental quality (IEQ). Listed publications include, “The Building Air Quality Action Plan”, texts of recent health hazard evaluation reports, and links to other related subjects such as asbestos, asthma and allergies, chemical safety, and work stress. Under “Other NIOSH Resources”, additional web sites and a list of Books and Monographs are provided.

### **Water Damage Restoration and Mould Documents**

**Remedial Procedures for Water Damage in Buildings**, T. Nathanson, 2001. [G]

<http://IAQconsultant.com>

Guidelines for building owners, managers, operators, and contractors faced with interior water damage. Addresses the need to act promptly, isolate and control the site, and restore damaged property to avoid microbial contamination. How to remediate materials, structural components, and the mechanical system, and a flow chart and tables are presented.

**Standard and Reference Guide for Professional Water Damage Restoration, IICRC S500**, Institute of Inspection Cleaning and Restoration, Vancouver, Washington, 1999.

[G]

<http://www.iicrc.org>

A procedural standard for use by those involved in the water damage restoration industry as well as a supplementary reference guide. The Standard addresses; Loss Assessment and Evaluation, Categories of Water, Principles of Drying, Structural and Contents Restoration, Monitoring, Final Inspection and Completion. The Reference Guide includes the following chapters; Microbiology Associated with Water Damage, Health Effects Associated with Microbial Contamination, Biocides and Antimicrobials, Employee Health and Safety, Occupational Exposure, Psychrometry, Water Damage Restoration Drying Equipment and Tools, Communication and Administrative Procedure, Inspection and Evaluations, Third-Party Evaluation of Remediation Effectiveness and Project Completion, Carpet Disengagement and Reinstallation, an Appendix, Regulation of Pesticides, and a Glossary.

**Standard and Reference Guide for Professional Mold Remediation, IICRC S520**, Institute of Inspection Cleaning and Restoration, Vancouver, Washington, 2004. [G]

This ‘consensus standard’ is intended to provide information about the remediation of mould-damaged structures and contents. Written primarily, for remediation companies it can be also used by persons who investigate mould complaints, write remediation specifications, protocols, or procedures, and manage remediation projects. The document is in two parts; a procedural Standard and a Reference Guide that supports the Standard and provides background information.

The Standard sections consist of; Principles of Mold Remediation, Contractor Qualifications, Safety and Health, Administrative Procedures and Insurance, Limitations, Complications, Complexities and Conflicts, Inspection and Preliminary Determination, Structural Remediation, HVAC Remediation, Contents Remediation, Post-Remediation Verification, Final Documentation, and Indoor Environmental Professionals. Appendices contain Mould Remediation Certification Authorities, and Suggested Guidance for the Selection and Use of Respiratory Protection During Mold Remediation. A Glossary of Terms, Sources, Abbreviations, Industry Acronyms, and Source Acknowledgement is also included.

**Clean-Up Procedures for Mould in Houses**, Canada Mortgage and Housing Corporation (CMHC), 2004. [G]

<http://www.cmhc-schl.gc.ca>

<https://www03.cmhc-schl.gc.ca/b2c/b2c/init.do?language=en>

This guide, primarily for homeowners and occupants, includes advice on how to identify and correct small-scale mould problems. Contents include an Introduction; Defining the Problem; Evaluating the Problem; Fixing the Problem, and Appendix A – Mold Biology; Appendix B – Surveying Indoor Moisture and Mold; Appendix C – Preventing Moisture Problems; Appendix D – Print Resources; Appendix E – Internet Resources; and Appendix F – Testing Resources.

**Fungal Contamination in Public Buildings: Health Effects and Investigative Methods**, Health Canada, 2004. [G]

[http://www.hc-sc.gc.ca/ewh-semt/pubs/air/fungal-fongique/index\\_e.html](http://www.hc-sc.gc.ca/ewh-semt/pubs/air/fungal-fongique/index_e.html)

This document is a revision of *Fungal Contamination in Public Buildings: A Guide to Recognition and Management*, 1995, which has been removed from circulation. The purpose of the report is to assist public health workers and others in the management of potential health risks associated with fungal contamination. Two sections are presented; the first is a review of internationally published studies of the health effects of indoor moulds, a discussion of potential effects in sub-populations, an overview of experimental studies on respiratory effects of moulds, and a discussion of the evidence linking mould exposure to adverse health outcomes.

The second part is a guide for the investigation of mould contamination in non-industrial workplaces. Sections include a Background, General Principles, Objectives of a Mould Investigation, and Methodological Considerations.

**Guidelines for the Investigation, Assessment, & Remediation of Mould in Workplaces**, Workplace Safety and Health Division, Manitoba Department of Labour, 2001. [G]

[www.gov.mb.ca/labour/safety/publication/guidelines/mould/mouldguidel.pdf](http://www.gov.mb.ca/labour/safety/publication/guidelines/mould/mouldguidel.pdf)

This guideline has been developed to provide general information to employers, workers, consultants, abatement contractors and others concerned with mould contamination in workplaces. The information is intended to establish minimum requirements to be considered when investigating and assessing mould complaint/concerns from workers and others. The guideline also establishes minimum remediation procedures to be followed when contaminated material is to be abated.

Contents include Introduction to Mould, Investigating Potential Contamination, Biocontamination Remediation Procedures and Hiring a Consultant to Help.

Other Provinces, notably Quebec, Ontario, Alberta, and British Columbia have water-damage and mould remediation documents on their respective web sites.

**Mould Guidelines for the Canadian Construction Industry**, Standard Construction Document, CCA-82-2004, Canadian Construction Association, 2004. [G]  
<http://www.cca-acc.com>

This document was developed as a national guideline to assist contractors (and all other stakeholders) in minimizing the potential for mould growth and to institute effective remediation practices, during building construction as well as in building design, operation and maintenance. Contents include; Introduction, Legal / Insurance Overview, Defining Mould, Health Risks, Construction Practices to Minimize Moisture Intrusion, Building Operation and Maintenance, Mould Assessment, Mould Remediation Guidelines (3 levels plus the HVAC system), Communication, Decommissioning / Demolition, Disposal of Mouldy Materials, and Guidelines For Selecting Mould Remediation Contractors. Appendix A provides a “Checklist for Visually Determining the Presence of Mould in an Existing Building”, and Appendix B lists mould remediation resources.

The CCA website also contains a 12-page document, “Mould: An Informational Brochure”.

**Guidelines on Assessment and Remediation of Fungi in Indoor Environment**, New York City Department of Health, 2000. [G]  
<http://www.nyc.gov/html/doh/html/epi/moldrpt1.html>

This edition is a revision of the 1993 guidelines that developed policies for medical and environmental evaluation and intervention to address toxigenic mould contamination. The revised document was expanded to include all fungi (mould) on the premise that while several mould species can produce mycotoxins, general exposure to moulds can cause allergenic reactions.

The document contains a discussion of potential health effects; medical evaluations; environmental assessments; protocols for remediation (4 levels plus 2 for the HVAC system); and a discussion of risk communication strategy.

**Mould Remediation in Schools and Commercial Buildings**, U.S. EPA, 2001. [G]  
[http://www.epa.gov/iaq/molds/mold\\_remediation.html](http://www.epa.gov/iaq/molds/mold_remediation.html)

This document presents guidelines for the remediation / cleanup of mould and moisture problems in schools and commercial buildings, and include measures designed to protect the health of building occupants and remediators. While designed primarily for building

managers, maintenance personnel and custodians, it can also be referred to by moisture and mould remediators and those with little or no experience with mould contamination.

Contents include; Investigating, Evaluating, and Remediating Moisture and Mold Problems; Checklist for Mold Remediation; Resource List; and References. Appendix A - Glossary; Appendix B – Introduction to Molds; and Appendix C – Communication with Building Occupants are also part of the document.

Canadian Wood Council and Forintek  
[www.durable-wood.com](http://www.durable-wood.com)

This web site contains information on Moisture and Wood, Moisture Control, Preventing Decay, Durability by Design / Treatment and a section (FAQ) on Bluestained (discoloured) Wood.

## **IAQ and Mould Books**

*Indoor Air Quality Handbook*, J. D. Spengler, J. M. Samet, J.F. McCarthy, eds. McGraw-Hill, 2000.

This book, with 71 chapters by numerous contributors is divided into the following parts; 1. Introduction; 2. Building Systems; 3. Human Responses; 4. Indoor Pollutants; 5. Assessing IAQ; 6. Preventing Indoor Environmental Problems; 7. Special Indoor Environments; and 8. Risk Assessment and Litigation

*Indoor Air Quality and HVAC Systems*, D.W. Bearg, Lewis Publishers, 1993.

A practical guide to those responsible for the design, installation, operation and maintenance or evaluation of heating, ventilating, and air conditioning (HVAC) systems with respect to the provision of good IAQ. Chapters include Introduction; Description of HVAC Systems; Individual Components of HVAC Systems; Evaluation Criteria for IAQ; Evaluation of the Ventilation System; Quantity of Outdoor Air Delivered to Occupants; Ventilation Characterization; Air Movement pathways and Pressure Relationships; Evaluation Tools and Techniques; and Sources of Air Contaminants.

*Humidity Control Design Guide for Commercial and Institutional Buildings*, Harriman, Brundrett, Kittler, ASHRAE, 2001.

This purpose of this book is to help professionals design humidity control systems for commercial buildings. It also covers psychometrics, human comfort, mould, dust mites, bacteria, viruses and presents a comprehensive design procedure for a variety of

buildings such as schools, offices, retail facilities, hotels, restaurants, museums, libraries, hospitals, dormitories, swimming pools, ice arenas and labs.

*Bioaerosols Assessment and Control*, Janet Macher, ed. ACGIH, 1999.

<http://www.acgih.org>

This book, written on the need to prevent occupational diseases by the recognition, evaluation, and control of bioaerosols, is divided into three parts: 1. The Basics, 2. Background Information, and 3. Specific Agents.

Part 1 describes an investigation strategy, health effects and symptoms, a building walkthrough, sampling plan, and data analysis and interpretation. Part 2 addresses medical roles, respiratory infections, sampling methodologies, remediation, biocides and anti-microbial agents. Part 3 contains chapters on bacteria, fungi, amoebae, viruses, dust mites, endotoxin, mycotoxin, antigens and microbial volatile organic compounds (MVOCs).

*Field Guide for the Determination of Biological Contaminants in Environmental Samples*. 2<sup>nd</sup> edition, Ling-Ling Hung, J. David Miller, and H. Kenneth Dillon. eds. American Industrial Hygiene Association, Fairfax, VA. 1996

<http://www.aiha.org>

This book was developed by experts in biosafety and biological contaminants to ensure that the presented materials and methods reflect prevailing occupational health and safety and industrial hygiene practices. Chapters include; Elements of Building Science, Microbial Ecology, Health Effects, Planning and Conducting a Survey, and Sampling Protocols and Equipment.

*Microorganisms in Home and Indoor Work Environments: Diversity, Health Impacts, Investigation and Control*, Brian Flannigan, Robert A. Samson, J. David Miller, editors, Taylor and Francis Inc. N.Y. 2001.

The first three sections of this book review the types of microorganisms in outdoor and indoor air, their growth and control in home and work environments, and their role in respiratory disease. The remaining sections address the twin problems of exposure assessment and identification and provide an assessment methodology. Keys and colour illustrations of close to 100 species are provided.



The Healthy Indoors Partnership (HIP) is a not-for-profit organization that catalyzes action on Canadian indoor environmental issues through multi-stakeholder collaboration. We connect people, ideas and resources from government, industry, educational and research institutions, and public interest groups to collaborate on common indoor environmental health issues.

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