



**A.I.R.M - Seminar**

# Indoor Air Exposure in Irish Buildings and the Law

**21<sup>st</sup> of September 2011**





## Agenda

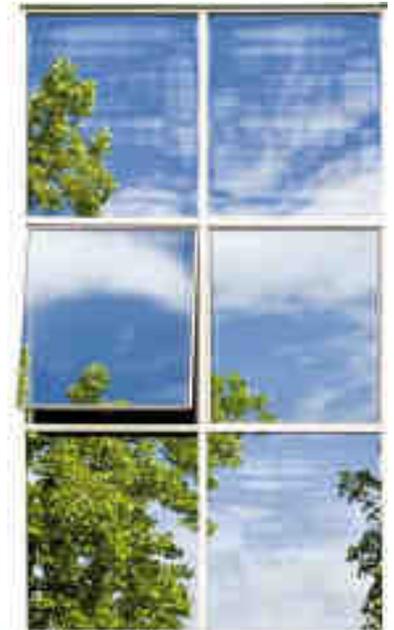
### 10.10am Presentation 1:

- Introduction
- Indoor Air – The Facts
- Exposures
- Irish Findings
- Applicable legislation
- Indoor Air Pollution and Health
- Basic strategies for improving indoor air quality

### 10.50am Tea / Coffee.

### 11.10 a.m. Presentation 2.

- Noise Monitoring and Noise Induced Hearing Loss
- Light Assessments
- Biological Exposure Risks in Non Office and Office Settings
- Exposure Limits





## About Us

- The airmid healthgroup Ltd is an Irish organisation established by a group of clinicians in 2007
- We have made it our mission to prevent ill health caused by exposure to indoor air pollutants
- **health friendly air™** is our goal - top quality indoor air that reduces health risks – independent verification

## A Multidisciplinary Approach

As a health based group we understand the effect that poor indoor air quality and particularly bioaerosols have on building occupant health

Clinicians

Occupational  
health advisers



Occupational  
hygienists

Specialist Laboratory  
Scientists in Mycology,  
Virology, Bacteriology,  
Allergy and Immunology

## Our group has 3 Integrated Divisions



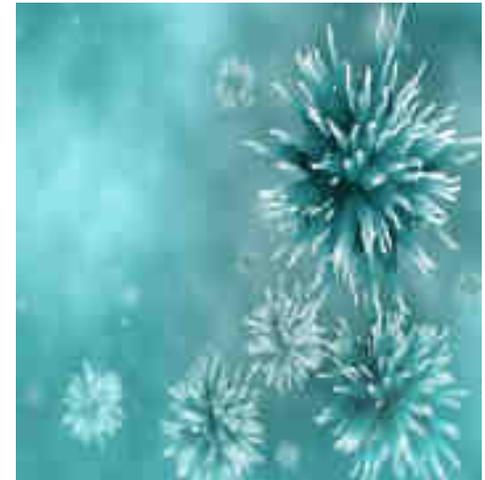


# Introduction to Indoor Air Quality



## IAQ v's IEQ

- **Indoor Air Quality (IAQ)** refers to the totality of attributes of indoor air that affect a person's health, well being and comfort.
- **Indoor Environmental Quality (IEQ)** is a generic term used to describe the physical and perceptual attributes of the indoor space. These include the thermal, acoustic and visual properties of the environment as well as the indoor air quality.





## The Facts About Indoor Air

- The World Health Organization (WHO) estimates that greater than one building in four has indoor air quality problems
- 90% of our time is spent indoors.
- Indoor air is more polluted than outdoor air (5 to 100 times).
- 20-60% of building occupants suffer from symptoms associated with unhealthy indoor air





## Sick Building Syndrome (SBS)

- **US EPA “Sick Building Syndrome” (SBS)** is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be widespread throughout the building.
- **UK HSE: How to deal with sick building syndrome (SBS) *Guidance for employers, building owners and building managers:*** Sick Building Syndrome should not be confused with specific illnesses that can be directly associated with workplaces, such as legionnaire’s disease, the effects of exposure to specific toxic substances in the workplace or to long-term cumulative hazards such as asbestos and radon.
- **US EPA “Building related illness” (BRI)** is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants.



## What are the Exposures?



## The Exposure Risks

- **Chemical exposures** from work processes, flooring, paint, furniture and cleaning products.
- **Formaldehyde** can be present when vapours off-gas from building materials (e.g., carpets, particleboard, fabrics), cleaning fluids, and adhesives
- Photocopiers and electrical equipment produce **ozone and particulates**
- **Carbon monoxide** from improperly ventilated combustion appliances
- Indoor exposure to **radon** can increase the risk of lung cancer
- **Contamination from Outside Sources** - Fresh air intakes, vents or windows located too close to sources of unpleasant odours or other contaminants are often a problem

## The Exposure Risks

- **Thermal comfort:** If the ambient indoor air temperature is too warm, occupants perceive the environment to be stuffy with little airflow - resulting in fatigue and lethargy.
- Low **relative humidity** levels can result in irritation and discomfort and heightens the overall perception of indoor air quality issues for individuals.
- **High humidity levels** can result in condensation within the building structure and on interior or exterior surfaces and the subsequent development of **moulds and fungi** and encourages **dust mite** growth.
- Very often **ventilation rates** are reduced to the detriment of the quality of the indoor air and the building occupants breathing that air. **Inadequate ventilation** means contaminants created by workplace processes are not diluted and are simply re-circulated around the building.



## Sustainable Building and Ventilation

- History has shown that a myopic focus on energy conservation in buildings can inadvertently lead to poor indoor air quality.
- It is now accepted that super tight, insulated buildings with minimal ventilation and low air change rates result in indoor air pollutants building up to sufficiently high levels as to threaten occupant health.
- To pursue energy conservation in buildings without taking the quality of indoor air into consideration puts building occupants at unnecessary health risk. Striking a balance between maximising energy conservation and creating a healthy, comfortable and productive indoor environment is crucial for sustainability
- A sustainable building is not just energy efficient, it has six fundamental principles:
  - Optimise Site Potential
  - Optimise Energy Use
  - Protect and Conserve Water
  - Use Environmentally Preferable Products
  - **Enhance Indoor Environmental Quality (IEQ)**
  - Optimise Operational and Maintenance practices

## The Exposure Risks

- Elevated air pollution and **noise** in an office can interact and negatively affect office workers by increasing the prevalence of SBS symptoms
- Artificial **lighting** causing glare, reflection and flickering.
- Biological agents such as **bacteria, viruses, moulds and dust mites** and their toxins are a common factor in indoor air pollution.
- Inadequate office cleaning practice can lead to **high levels of microorganisms** indoors.
- Microbiological testing has found hundreds of thousands of bacteria on hot spots like printer buttons, desktops, keyboards and other surfaces. These tiny organisms can then become airborne and are invisible to the naked eye. They may be inhaled, either **alone or attached to particles of dust**.

## The Exposure Risks

- A primary source of indoor air contamination can be the **bacterial and fungal colonisation of air filters, heat transfer coils and ductwork** within the system. A large number of studies worldwide have shown that high levels of microbial contamination in air samples taken inside a building can be associated with microbial growth in the air distribution ducts.
- Because of the climate in Ireland, **dust mite levels** are higher than in some other countries, emphasising the importance of this allergen here. High allergen levels can be found in carpets, furniture and soft upholstery.
- In terms of our **workplace findings in 2010, 15% of those workplaces health friendly air™ surveyed** were found to have levels of dust mite concentration that increases the risk for sensitization and bronchial hyperactivity.



## Other HFA Findings



## Irish Buildings

- Eight out of ten of the premises tested had inadequate levels of ventilation which caused a build up of contaminants in the air and increased ill health and absenteeism among employees.
- In the majority of cases adequate ventilation levels were not being provided which was leading to a rise in carbon dioxide levels and subsequent building occupant symptoms such as headaches, nausea and fatigue.
- The results also concluded that in 1 case the primary source of indoor air contamination appeared to be biological contamination of the Heating, Ventilation and Air Conditioning (HVAC) system.



## Some Case Studies

**Case 1:** An open plan 4 storey office  
**Problem:** Headaches, nausea, fatigue.  
**HFA Approach:** Full indoor Air Audit  
**Result:** High levels of Carbon dioxide, TVOC' and bacteria caused by inadequate levels of ventilation  
**Outcome:** Increased levels of ventilation, symptoms resolved.

**Case 2:** A 5 storey office building.  
**Problem:** Respiratory issues.  
**HFA Approach:** Full Audit with HVAC assessment.  
**Result:** High levels of mould found in AHU.  
**Outcome:** HVAC system cleaned and reinstated. Repeat testing provided "clean bill of health".

**Case 3:** An historic building  
**Problem:** Respiratory/allergic issues.  
**HFA Approach:** Full indoor air audit  
**Result:** High levels of airborne mould in some areas.  
**Outcome:** Introduction of air cleaners and investigation into source of mould.

**Case 4:** A large multi national organisation  
**Problem:** None. Corporate Standard  
**HFA Approach:** Full Audit with HVAC assessment.  
**Result:** All levels were within best practice guidelines.  
**Outcome:** Written documentation of risk assessment.



## Some Case Studies

### **Case 5:** A Private Residence

**Problem:** Acute Respiratory Symptoms.

**HFA Approach:** Full Indoor Air Audit

**Result:** High levels of Stachybotrys Mould in the Air, source found and confirmed in surface sampling in the attic.

**Outcome:** Remediation ongoing, await repeat sampling.

### **Case 6:** Old Georgian Building – Naturally Ventilated

**Problem:** Complaints of headaches and nausea.

**HFA Approach:** Full Audit .

**Result:** Total Volatile Organic Compound (TVOC) levels were elevated. Office had been painted 6 weeks previously. A review of the material safety data sheets (MSDS) revealed that both the undercoat and the gloss had a high VOC content.

**Outcome:** Office occupants relocated for 4 weeks and high levels of ventilation introduced. A repeat survey confirmed TVOC levels had returned to normal. The office was reoccupied.

### **Case 7:** Mechanically Ventilated Office

**Problem:** Allergic issues

**HFA Approach:** Full indoor air audit

**Result:** Very high levels of house dust mite and total suspended particulate. Visible build up of dust throughout the office.

**Client Outcome:** Improved cleaning programme was introduced to the office.

### **Case 8:** A large 5 storey open plan office

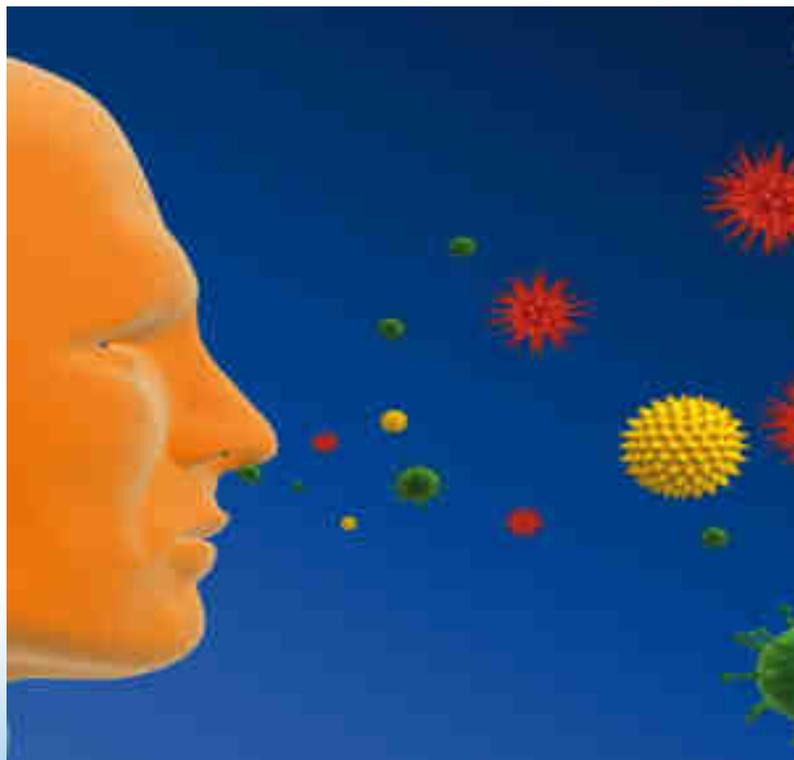
**Problem:** 1 employee diagnosed with Hypersensitivity Pneumonitis.

**HFA Approach:** Full indoor Air Audit

**Result:** All levels were within best practice guidelines.

**Outcome:** Written documentation that results of Indoor Air Audit do not give cause for concern with regard to building occupant health.

## The Legislation and Guidance





## Applicable Legislation – General

*The Safety, Health and Welfare at Work 2005*

### SECTION 3 - EMPLOYERS DUTIES

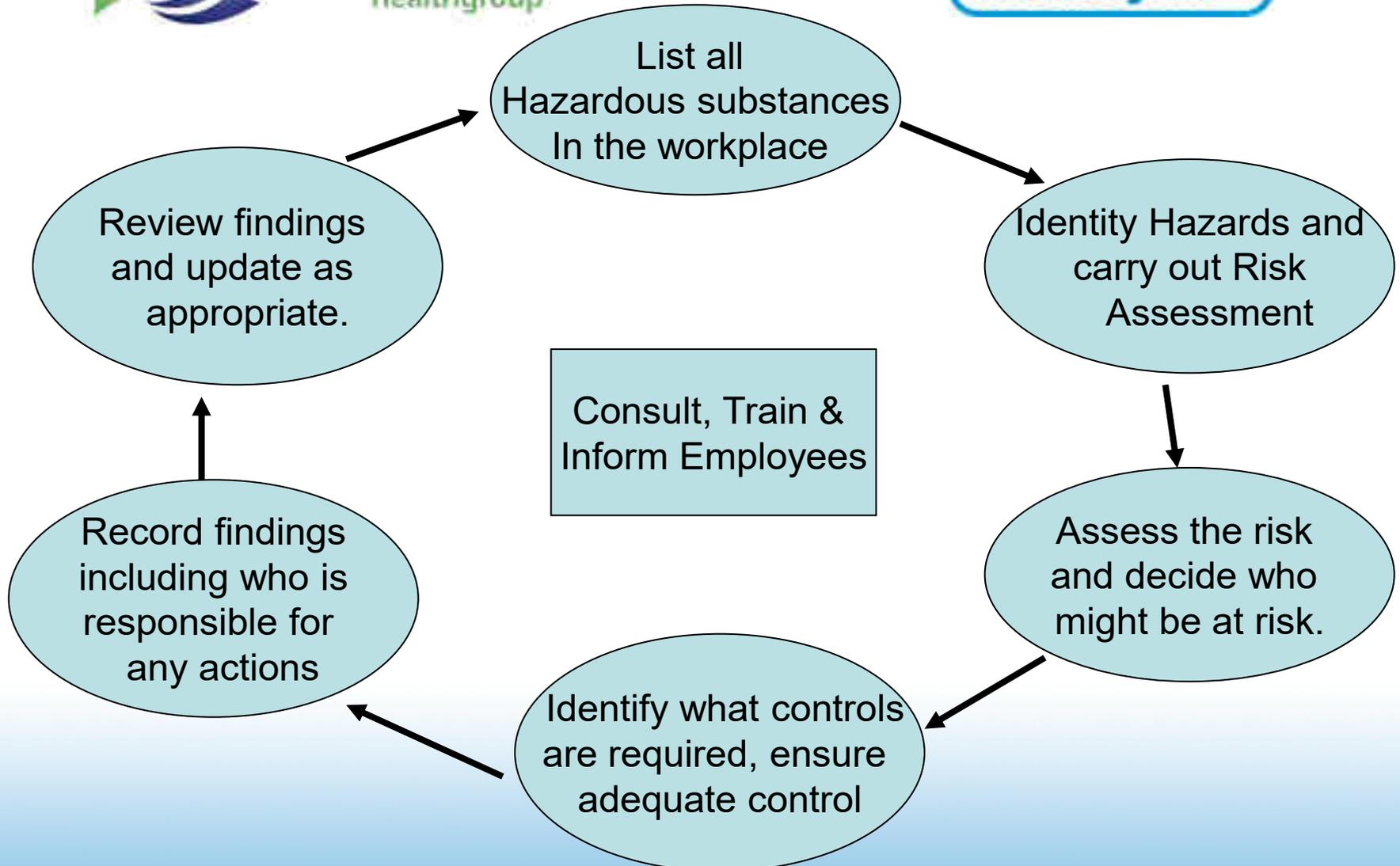
- Employers (including self-employed persons) are primarily responsible for creating and maintaining a safe and healthy workplace.
- Whether a call centre, an office, a manufacturing or a pharmaceutical facility employees have a legislated right not to be exposed to hazards in the workplace that may lead to acute or chronic, long-term health problems.



## Applicable Legislation – General

### Risk Assessment and Safety Statement

- The law requires that those that control workplaces must identify and control hazards in the workplace.
- A hazard is defined as anything with the potential to cause harm
- Workplace indoor environmental hazards should be managed systematically like all other workplace hazards through comprehensive risk assessment:
  - Identify hazards
  - Assess risks
  - Decide Precautions
  - Record the findings
  - Review and update





## Applicable Legislation

### *The Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 and the 2010 Code of Practice*

- Chemical risk assessment must be carried out for any hazardous substances on site in accordance with the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001.
- The purpose of a risk assessment is to enable employers to make a valid decision about the measures necessary to prevent or control the exposure of his or her employees to hazardous substances arising from the work activity.

## Applicable Legislation

### *The Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 and the 2010 Code of Practice*

- Where available levels are compared to occupational exposure limit values (OELV's) as set out in the 2010 Code of Practice.
- OELV's provide a basis for ensuring that exposure to airborne contaminants in all workplaces are controlled in such a way as to prevent adverse health effects.
- While these OELV's are applicable to all workplaces, these standards were originally designed to protect workers in industrial environments.
- Additionally just because a substance does not have an OELV in the 2010 ACOP does not mean it is not hazardous.
- So whether an exposure has been assigned an OELV or not it represents good practice to compare results to other available international limits set by bodies including legislators and governmental, professional and trade organisations.

## Applicable Legislation

- ***Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) - Ventilation of enclosed places of work.*** An employer shall ensure that -
  - a) sufficient fresh air is provided in enclosed places of work, having regard to the working methods used and the physical demands placed on the employer's employees,
  - b) if a forced ventilation system is used, it is maintained in working order and any breakdown is indicated by a control system if necessary for the safety and health of employees,
  - c) any deposit or dirt likely to create an immediate danger to the safety and health of employees by polluting the atmosphere is removed without delay.

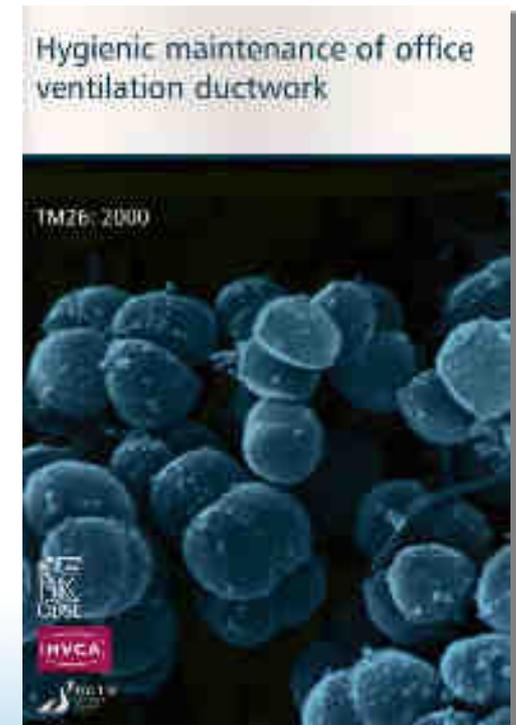


## Standards and Guidance

- **ASHRAE 62.1 2010** Ventilation for Acceptable Indoor Air Quality
- **ASHRAE Standard 55 2010**, Thermal Environmental Conditions for Human Occupancy
- **Health and Safety Executive:** How to deal with sick building syndrome. Guidance for employers, building owners and building managers.
- **Health and Safety Executive:** General Ventilation in the Workplace. Guidance for Employers

## Standards and Guidance

- **Building Air Quality** – A guide for Building Owners and Facility Managers US EPA, Centers for Disease Control, National Institute for Occupational Safety and Health
- **CIBSE standard TM26:2000** “Hygienic Maintenance of Office Ventilation Ductwork”. It compliments the BSRIA Guidance on ventilation system hygiene, and advice given by HVCA in their guide to Good Practice on ductwork hygiene.
- US EPA
- Health Canada



## Standards and Guidance

- Following two personal injury claims against the State and significant litigation activity in the US, where ill health was allegedly caused by exposure to mould, the SCA identified mould as a potential source of further legal action. In order to be in a strong position to defend any similar claims that may arise in the future, the State Claims Agency (SCA) commissioned a survey of moulds in various State buildings.
- Using the survey findings, they prepared guidelines for Accommodation Officers / Managers of Buildings, Maintenance and Cleaning Staff, in all State Authorities. These set out clearly how to prevent mould growth occurring and manage the issue if it does.
  - *Guidelines for Cleaning Staff on Managing Mould Growth in State Buildings*
  - *Guidelines for Maintenance Staff on Managing Mould Growth in State Buildings*
  - *Guidelines for Managing Mould Growth in State Buildings*
- WHO Guidelines for Indoor Air Quality Dampness and Mould 2009

## Biological agents in the workplace - Legislation

- The Safety, Health and Welfare at Work (Biological Agents) Regulations 1994 as amended in 1998 (S.I. No.146 of 1994 and S.I. 248 of 1998) set down the minimum requirements for the protection of workers from the health risks associated with biological agents in the workplace.



## Biological agents - Legionnaires' Disease

- Legionnaires' disease is a potentially fatal form of pneumonia, classified as a Group 2 biological agent.
- People may get infected when they breathe in tiny water droplets contaminated with elevated concentrations of *Legionella* bacteria.
- The bacteria multiply in warm water (20°C – 45°C), with the presence of nutrients such as rust, and biofilms (slime) which are likely to form when water is allowed to stagnate.
- If a building has a potential source of aerosols a written assessment must be carried out by a competent person:
  - a) Evaluate the risk and decide on precautions (As per L8 and HPSC)
  - b) Record findings and advise on control
  - c) Create a Legionella Log book which will monitor Legionellosis management and control measures in buildings.

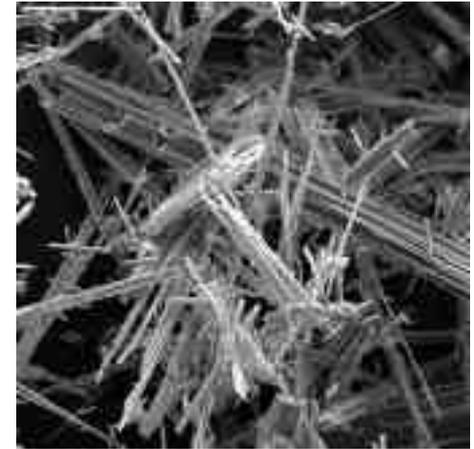
## Applicable Legislation - Asbestos

- Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and the Safety, Health and Welfare at Work (Exposure to Asbestos) (Amendment) Regulations 2010.
  - ACM's installed between 1960s and the mid1980s, asbestos cement until 2000.
  - The use of asbestos and ACMs was banned on a phased basis under legislation/general prohibition in 1994,1998 and 2000.
  - Products/ materials containing asbestos, remain in place until they are disposed of or reach the end of their service life.
  - The only way to be certain that a building has asbestos is to have an asbestos survey carried out a by competent person. In order to verify that a material contains asbestos, material is assessed and microscopically examined by a competent person.
  - Unless the ACM is in poor condition or has been disturbed or damaged the risk of exposure is minimal.

## Applicable Legislation - Asbestos

### Before starting any work:

- Has an asbestos survey been carried out?
- If you uncover any hidden material or dust which you suspect may contain asbestos, stop work immediately and get advice from a competent person.
- If you damage any asbestos containing material, stop work immediately and get advice from a competent person. Remember asbestos cement roofs are fragile – don't walk on them.
- Never handle, disturb or remove asbestos insulation yourself. The law allows only trained personnel to do this in conformity with strict regulations and controls.
- Based on a written risk assessment, where the planned asbestos-related work activity will expose or could expose workers to a concentration of asbestos fibres in air in excess of the exposure limit value, an employer must submit a written notification to the Health and Safety Authority 14 days before commencing any work.

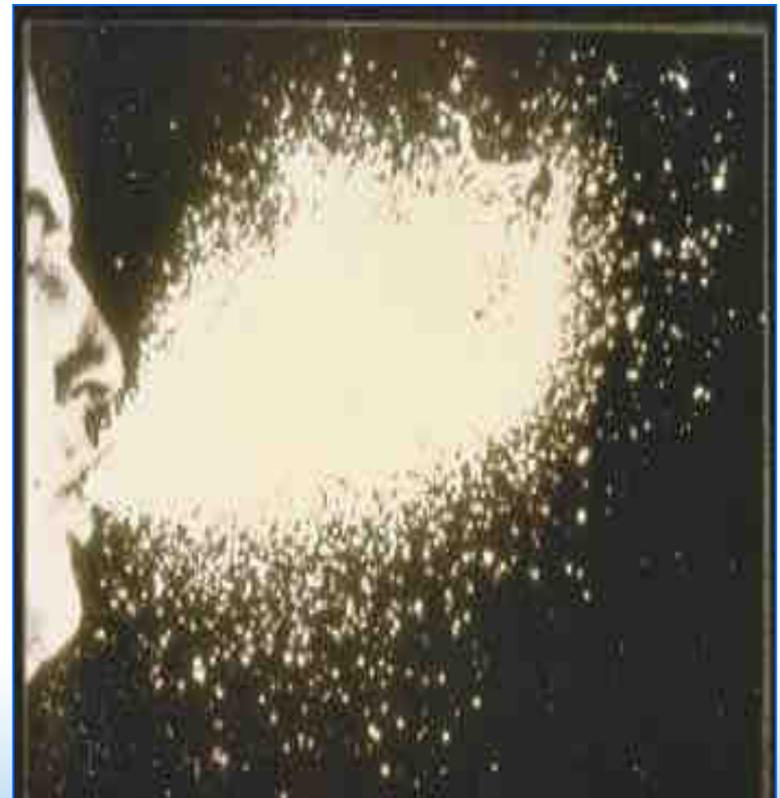


## Applicable Legislation – Noise, Light and Radon

- Safety, Health and Welfare at Work (General Application) Regulations 2007
  - Chapter 1 part 8 Natural and artificial lighting.
  - Chapter 1 of Part 5 Control of Noise at Work
- ***Radiological Protection Act, 1991***, and its supplementary legislation - particularly the [Radiological Protection Act 1991 \(Ionising Radiation\) Order, 2000 \(SI 125 of 2000\)](#). The RPII is responsible for implementing this legislation. The RPII recommends that all workplaces, especially those in [High Radon Areas](#), should be measured for radon. By law the RPII can direct any employer to have radon measurements carried out.

## Health Symptoms

- Headaches, eye, nose, throat irritation
- Dizziness and nausea
- Difficulty in concentrating and fatigue
- Increased incidence in infection
- Increased incidence of cough, asthma and respiratory problems
- Complaints of unpleasant odours and stuffiness
- Moisture and Microorganisms in buildings can cause infections, allergic or hypersensitivity reactions and irritant reactions.



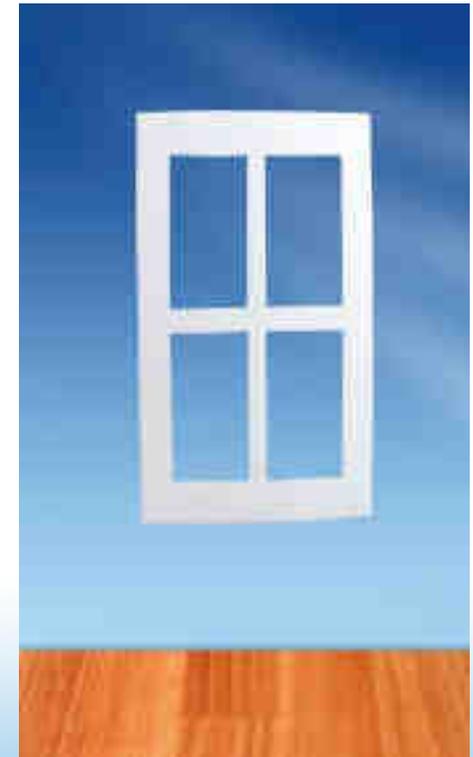
## Other health effects

- **Asthma** as a result of exposure to a respiratory sensitiser such as flour dust, soldering flux, foam insulation, carpet manufacturing, plastic, paint, electronic soldering flux, latex rubber, fish protein, laboratory animals, wood dusts, glues/resins, gluteraldehyde (healthcare). (See HSA Guidelines on Occupational Asthma).
- **Cancer**, which may appear long after the exposure to the chemical that caused it such as benzene, etc.
- **Loss of consciousness** as a result of being overcome by toxic fumes such as solvent vapours.

# Indoor Air Risk Assessment

## Ignorance is no defense !!

- The potential threat of litigation, resulting from exposure to poor quality indoor air, can result in a financial risk liability for employers.
- This risk should be managed, controlled and documented in the company safety statement just like any other office hazard such as slips, trips and falls or working with display screen equipment.
- The only way to assess this risk is to measure it. An indoor air audit will provide your organisation with a written risk assessment that clearly identifies the hazard, assesses the risk and recommends control measures for the management of workplace air.



## Basic strategies to ensure good indoor air quality

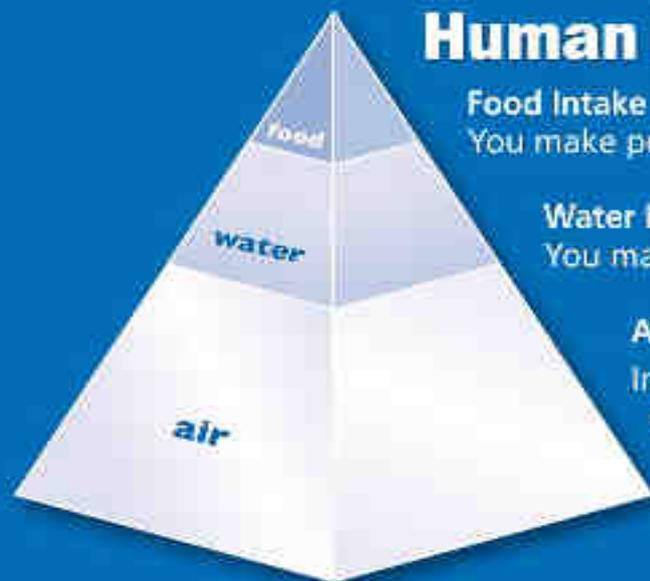
- **Source Control** - the most effective way to improve indoor air quality is to eliminate individual sources of pollution or to reduce their emissions
  - Building materials, furniture
  - HVAC positioning
  - Cleaning products
  - Chemical storage
  - Isolate emitting equipment
  - HVAC maintenance
  - Control of moisture
  - Good cleaning techniques

## Basic strategies to ensure good indoor air quality

- **Ventilation** – Sufficient fresh air should be provided (ASHRAE 62.1 2010 - 8.5 litre per person per second (10 l/s-1person) (Minimum flow rate of 8 litres per second per person - HSE - how to deal with sick building syndrome)
- **Filtration** - Filtration systems can be used to reduce the concentration of airborne contaminants such as biological and total suspended particulates.

# the air we breathe

## Human Body Intake



### Food Intake

You make positive healthy choices about the food you eat.

### Water Intake

You make sure you drink clean filtered water.

### Air Intake

Indoor Air pollution is ranked 5th as a cause of ill health worldwide.

You spend 90% of your time indoors.

**Is it time your indoor air had a health check?**



## Discussion

