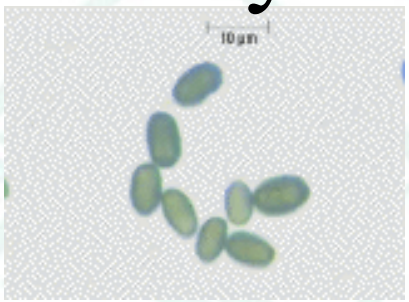
The Prevention and Minimization of Mould Growth Caused by flooding



Presented By:

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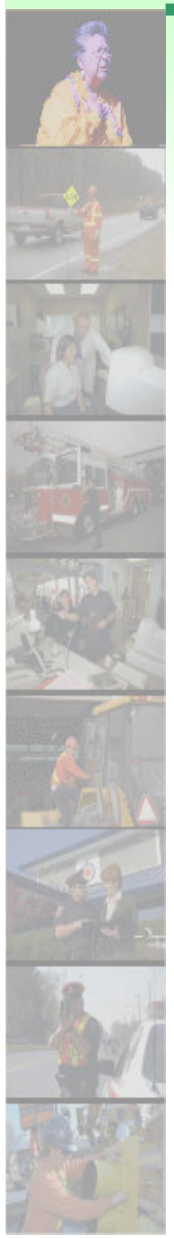
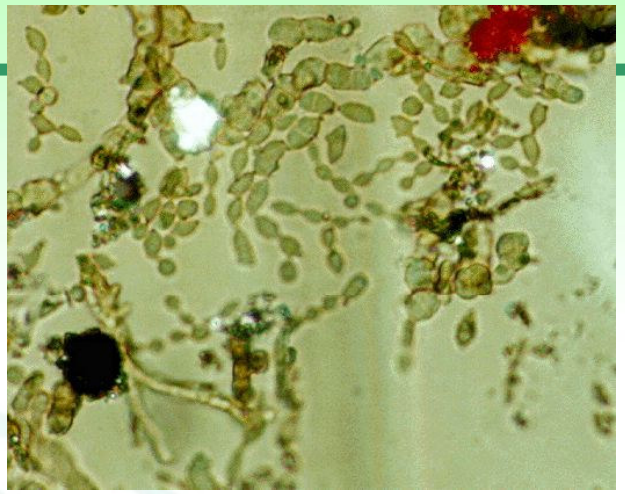


Objectives

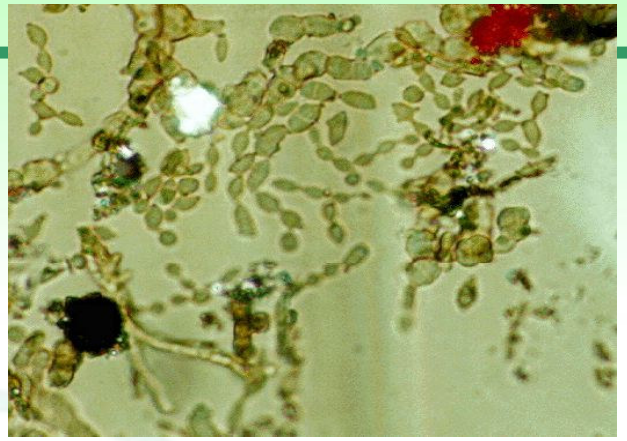
- Recognize indoor mould
- Conduct visual inspections
- Categorize mould contamination
- Determine if and when to collect samples
- Interpret lab results
- Perform effective mould remediation

Moulds

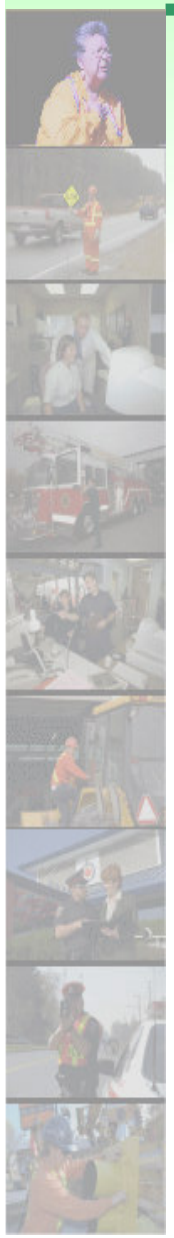


- **Fungi are everywhere!**
  - > 3 Million species?
- Include mushrooms, fungi, and yeast
  - Cladosporium, Penicillium, Alternaria, Aspergillus, Mucor
- Filamentous organisms reproduce by tiny spores
    - Air
    - Water
    - Insect-borne
- Spore (2 – 20 μm) → Hyphae → Mycelium → Fruiting Bodies (conidiophores) → Fungi

Moulds



- Filamentous organisms that produce spores
- May produce VOC – musty odour and other effects
- Some produce mycotoxins: non volatile
  - Mechanism for mold to kill off competitors i.e. penicillin is a mycotoxin



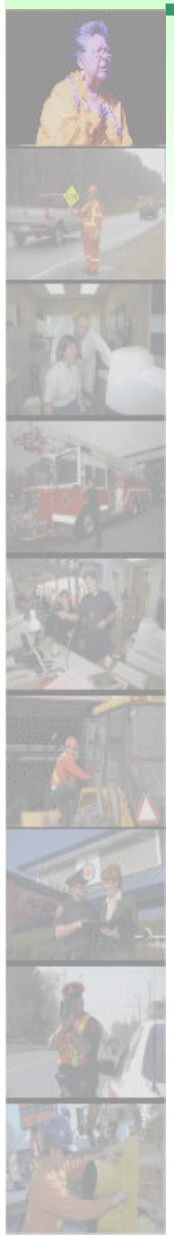
Where are Moulds Found?

- Everywhere!
  - Outdoors
    - shady
    - damp areas
    - decomposing vegetation
  - Indoors
    - high humidity
    - water intrusion

Outdoor Fungal Sources

- Phylloplane (leaf surface) fungi
  - summertime levels can reach 10^4-10^5 CFU/m^3
  - major allergens in seasonal hayfever
  - e.g., *Alternaria*, *Cladosporium*, *Epicoccum*

- Soil & litter fungi
  - tracked indoors on footwear
  - aerosolized during construction/excavation
  - e.g., *Aspergillus* and *Stachybotrys*

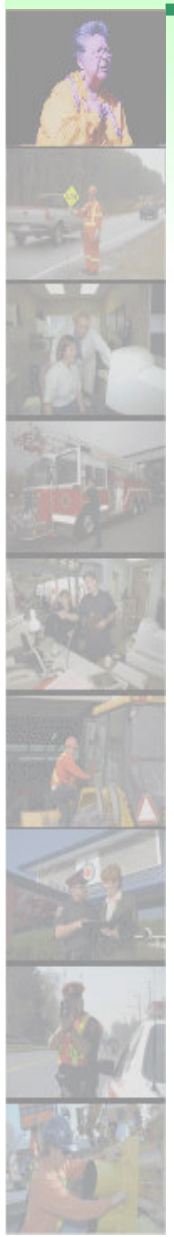


Indoor Fungal Sources

- Growth on damp organic substrates
  - construction materials
  - ceiling tiles, broadloom, drywall, Kraft paper
  - sinks/floor drains
- Contamination of AHU/HVAC system
  - maintenance failures
    - filter media, humidifiers, perimeter units
    - old equipment, poor design, ceiling plenums, etc.

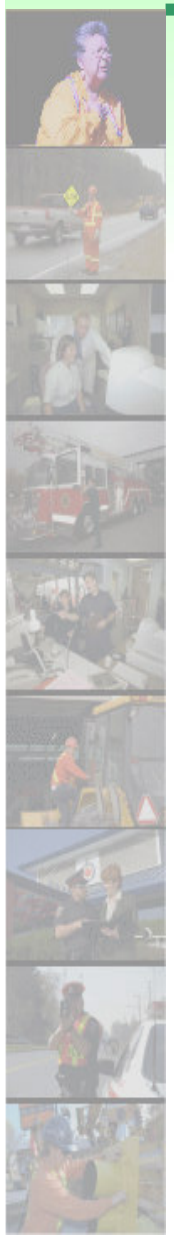
Indoor Fungal Accumulators

- Dust
- Carpets
- Ductwork
- Upholstered furnishings
- Potted plants….



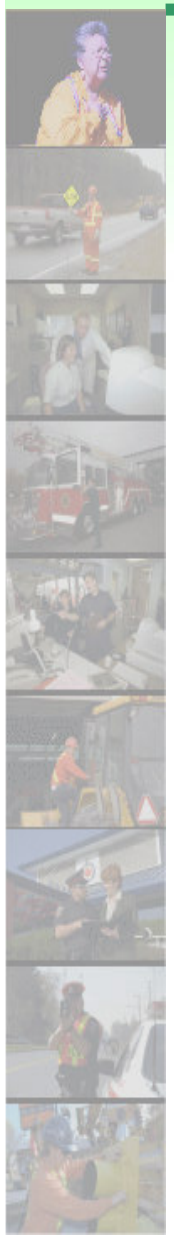
Required Conditions For Fungal Growth

- Oxygen
- Water (high RH, flooding, leaks, etc.)
- Temperature
  - » 4°C - 37°C, room temp. perfect
- Carbon Source (food)
- Time



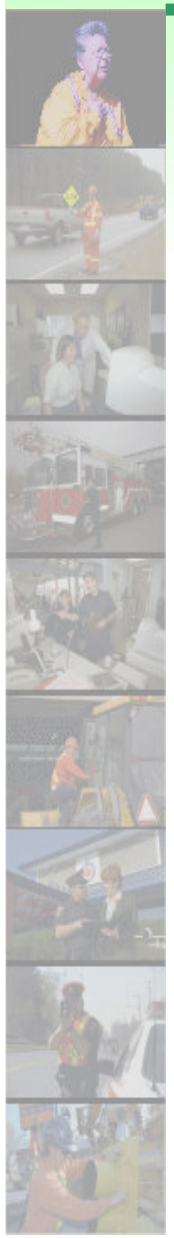
Common Indoor Moulds And Their Health Effects

- Indoor spores generally reflects outdoors unless there is a source of contamination
- Many different types of fungi have been reported indoors (about 150 spp) but only a few are frequently found indoors
- Most common genus is *Cladosporium*
- *Penicillium* and *Aspergillus* often exist at higher concentrations indoors compared to outdoors.



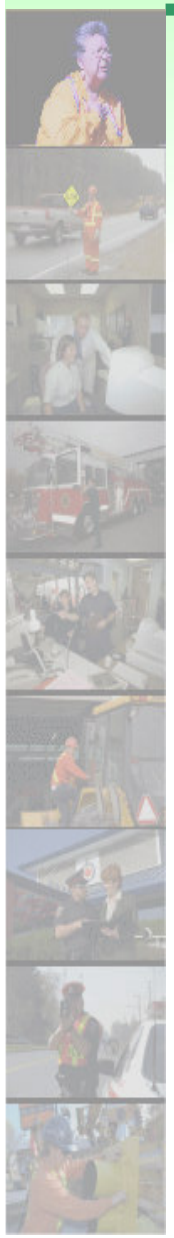
Most common moulds in water damaged buildings and their frequency are:

- ✓ *Penicillium* (68%)
- ✓ *Aspergillus* (56%)
- ✓ *Chaetomium* (22%)
- ✓ *Ulocladium* (21%)
- ✓ *Stachybotrys* (19%)



Most common moulds in water damaged buildings and their frequency are (Cont.):

- ✓*Cladosporium* (15%)
- ✓*Acremonium* (14%)
- ✓*Mucor* (14%)
- ✓*Paecilomyces* (10%)
- ✓*Alternaria* (8%)
- ✓*Verticillium* (8%)
- ✓*Trichoderma* (7%).



Known Toxigenic Moulds

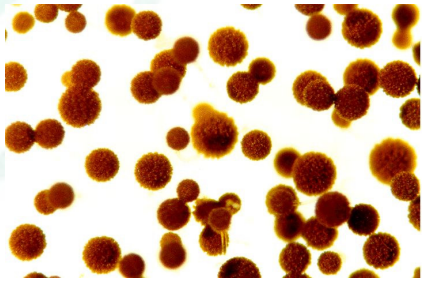
- *Stachybotrys chartarum (atra)*
- *Aspergillus* species
- *Penicillium* species
- *Trichoderma* species
- Etc.

Stachybotrys chartarum

- Produces slimy heads of wet black conidia
- Requires very high moisture content
- Different strains → different toxins
- Grows on cellulosic materials
- Occurs widely in North America

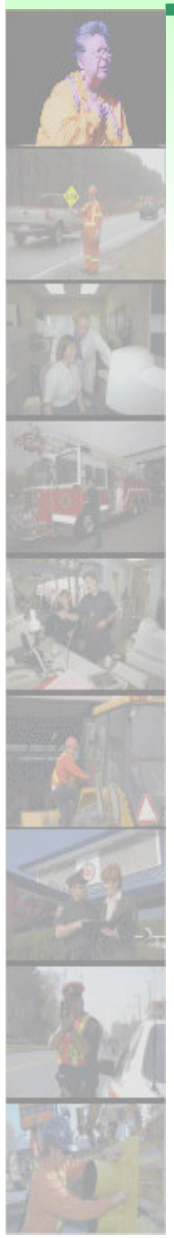
Aspergillus

- Genus containing > 100 species of which 15 are commonly isolated inside buildings
- *A. flavus*
  - highly toxic aflatoxins (carcinogenic & teratogenic)
  - unknown risk for expected building-type exposures
- *A. fumigatus*
  - aspergillosis (lung disease)
- *A. versicolor*
- *A. niger*



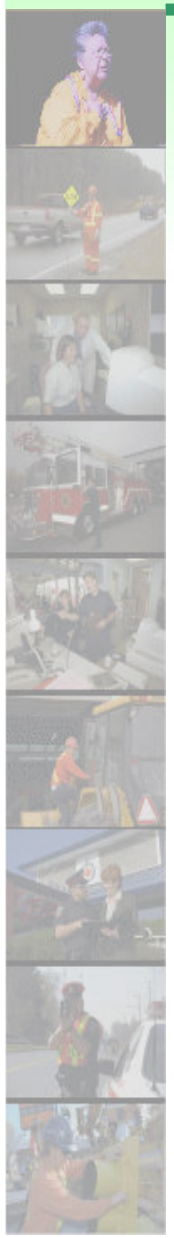
Penicillium

- Some species are common indoors
- Can be an indicator of past water damage
- Associated with damp environments or water damaged building materials
- Conidia and spores of *Penicillium* and *Aspergillus* are indistinguishable on direct exam



Common Indoor Moulds And Their Health Effects

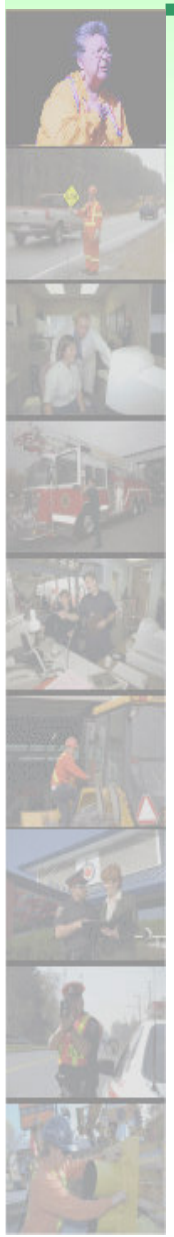
- *Cladosporium*
  - Occur more often outdoor air than indoors.
  - Secondary wall colonizers after the primary ones such as the *Penicillium* species and *A. versicolor*
  - Found in various materials by laboratories Is allergenic
  - Atopic infants are the most sensitive against *Cladosporium* spp. allergens,
  - In skin tests positive reactions were found in 42% of children aged up to four years.
    - With increasing age, the positive reactions showed decreasing tendency.
  - Important species
    - *Cladosporium cladosporioides*
    - *Cladosporium herbarum*



Field Investigations

(Health Canada)

- Phase I Assess magnitude of problem
- Phase II Identify problems in building environment
- Phase III Environmental sampling
- Phase IV Risk communication
- Phase V Destructive testing
- Phase VI Remedial actions



Recognizing Mould Growth

- Conditions favourable?
- Look for signs – site investigation
- Determine scope of problem
- Confirm – seek professional help

Mould Remediation Guidelines

- Once mould has grown in a building, it has to be removed (also referred to as mould remediation/abatement)