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# ENVIRONMENTAL RISK MANAGEMENT IN CONFINED SPACES.

## A STUDY CASE OF AN ARCHIVE LIKE A MODEL OF INDOOR ENVIRONMENT INVOLVED WITH BIODETERIORATION.

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### HIGHLIGHTS

#### Sick building syndrome (SBS)

Situation in which occupants of a building experience acute health effects that seem 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.



#### Aerobiology

Science that studies the biological aerosol, such as bacteria, fungal spores, insect, pollen and virus, and its effects on the impactor surfaces.

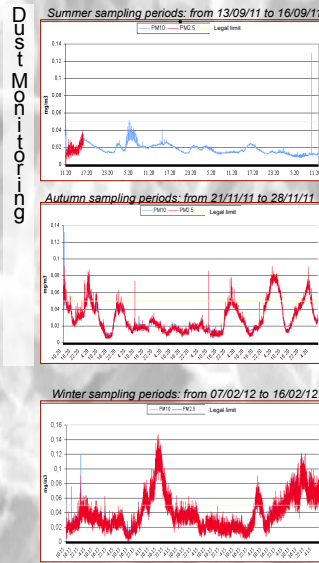
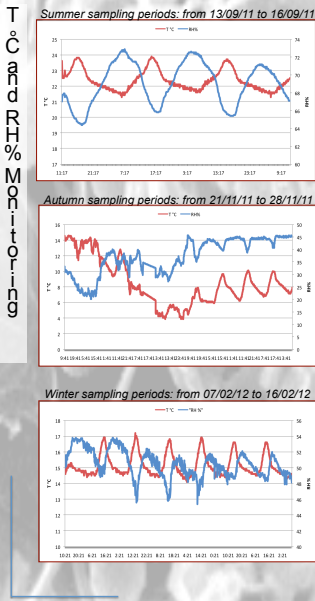
### Introduction

Proper management of specific indoor environments, such as those that preserve Cultural Heritage, can not be separated by taking into account the impact that they may have on human health. Particular interests are the Historical Archives, where cellulolytic microfungi and bacteria have a very comfortable environment for their development. In fact, one of the major cause of degradation of the paper is the biodeterioration, which it develops specially with particular environmental conditions. Therefore, it is necessary to study also the aerobiology linked with environmental Archive, to understand the conservation state of the documents and, also, the possible risk for the Archive's operators and for people who frequent these environments.

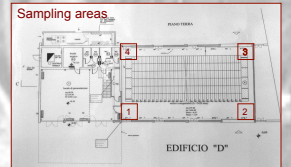
### Methods

- Seasonal environmental monitoring (T °C and RH%)
- Dust monitoring (PM10, PM2.5) with Laser photometer DustTrack Aerosol Monitor
- Seasonal aerobiological sampling: active (Volumetric Sampler Buck-VSS™) and passive (Petri dishes with MEA-Malt Extract Agar- and NA-Nutrient Agar-)
- Biological characterization of deposited dust: Microbial Buildup (MB, number of microorganisms accumulated on a certain surface during 30 seconds of sampling) and Hourly Microbial Fallout (HMF, number of microorganisms that fall out on a certain surface during 1 hour)
- Biological characterization of Archival Documents

### Results



**Study case**  
Contemporary Political History Archives site in Ca' Tron, Treviso (Italy) in the Veneto countryside



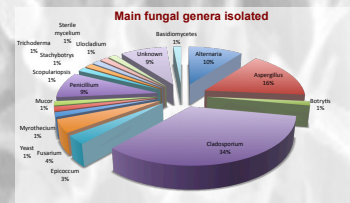
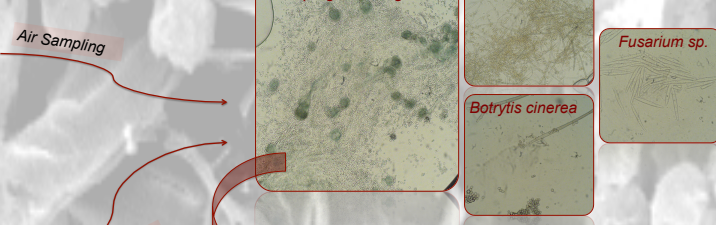
| Sampling areas                  | Autumn MB (UFC/dm <sup>2</sup> ) | Autumn HMF (UFC/dm <sup>2</sup> ) | Winter MB (UFC/dm <sup>2</sup> ) | Winter HMF (UFC/dm <sup>2</sup> ) |
|---------------------------------|----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|
| A. Like area 2                  | 508                              | 640                               | 334                              | 790                               |
| B. Like area 2 but on the floor | Uncountable                      | Uncountable                       | 3229                             | 1320                              |
| C. Central bookcases            | 196                              | 231                               | 236                              | 231                               |
| D. Like area 3                  | 375                              | 404                               | 185                              | 202                               |
| E. Bookcase floor area 4        | 594                              | 565                               | Uncountable                      | 1326                              |

\*No sampling in Summer '11.

### Conclusions

The monitoring and the analyses carried out in the Archive emphasized:

- a general lack of stability in the parameters of T °C and RH%, essential for an ideal conservation of the archival documents, (UNI 10829 normative range 13-18 °C ±1,5 °C and RH 50-60% ±5%);
- aggravation of cleanliness conditions of the Archive, measured by means of suspended particles monitoring, in particular PM10 and PM2.5;
- the main fungal genera of outdoor environments have been detected: *Alternaria*, *Ulocladium* and *Cladosporium*, but most of all we singled out the chief genera that colonize indoor and typically cellulolytic settings: *Aspergillus*, *Penicillium*, *Stachybotrys chartarum*, *Trichoderma viride* and *Myrothecium*. These genera, together with *Fusarium* and *Mucor* are known as highly allergenic for humans.



It belongs to the same group of *A. fumigatus*, principal responsible of Aspergillosis.  
In Italy, its presence in the workplace is governed by these normative references:  
- D. Lgs 81/2008 (ex D. Lgs. 626/94) and subsequent changes D. Lgs. 106/09;  
- 2000/54/CE directive.

**Keywords:**  
Aerobiology  
Indoor Air  
Cultural Heritage  
Human Health

### References

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