

Biological Agents

Toolbox Talk



Biological agents responsible for indoor air pollution of buildings

- viruses
- microbes
- bacteria
- fungi
- parasites



Microbes, fungi and bacteria when found in proper conditions are grown in dense formations called colonies. Under certain conditions, these formations may cause adverse health effects in case of exposure to them.

The development of micro-organism colonies may happen in places where:

- There is a lot of moisture
- There is heat
- There is organic matter that can serve as nutrient
- There is lack of oxygen (for the anaerobic microorganisms)
- There are mechanical facilities that augment microorganism growth (e.g. fermentation of materials, processing systems, cleaning and recycling of cutting liquids, cereal dust)

Epidemics due to dangerous micro-organisms

In the summer of 1976, at the Bulleveau-Staford Hotel in the US, during an annual reunion of American retired legionnaires, a epidemic pneumonia attacked 221 people and caused 34 deaths. Later, it was determined that the cause of this pneumonia was a type of gram negative aerobic bacterium, named legionella pneumophilus and was isolated in water vapor from the air conditioning systems.

The same micro-organism was also responsible for a previous pneumonia epidemic, at the same hotel in 1974, and for the lung disease that occurred in 1968, to 144 workers and visitors to a Pontiac hospital in Michigan and was named Pontiac Fever



Microbial air load

- There are no legally established numerical limits for the recommended level of microbial load in an area.
- Nevertheless, indicative values of total microorganisms concentration in indoor air are suggested by:
- **ACGIH** (American Conference of Industrial Hygienists) :
100- 1000 CFU/m³ and
- **IAQA** (Indoor Air Quality Association) : **<300 CFU/m³**

Measurements of harmful factors

❑ Preliminary examination

- Collection of information (former measurements)
- Indicative measurements

❑ Measurements Strategy

- Choice of factors that will be measured
- Finding appropriate methodology and measurement instruments
- Conversation with the responsible persons for the accurate definition of the time and points of measurement

❑ Conducting measurements by also recording the exact environmental conditions

❑ Results

- Recording and evaluating the results
- Conclusions

❑ Measurements Repetition

Determination of biological factors

Working Air Quality Microbial Charge

- Aspiration of a known volume of air over a predetermined period of time through an open sterile plate with a substrate (agar) or the use of a direct open plate to allow microbial colonies to grow
- After that, an accelerated oven incubation and micro-organisms colony calculation (CFU) per m³ of air, with a microscope and colony counter.



Determination of biological factors

Working Surface microbial load control

A sample is taken with sterile patches of surfaces (eg floor, work benches) and then microbiological analysis is performed in the laboratory (eg total microbial load, escherichia coli, staphylococcus aureus etc.)



Determination of biological factors

Determination of Legionella

Collection of a sample of water in a sterile container with specific sampling procedure and then laboratory analysis (eg cultivation)



Sampling

Care must be taken since the sampling procedure must be conducted very carefully since the sample is both time as well as methodology sensitive.

It is best that sampling is conducted by only trained professionals in order not for the sample to be contaminated.