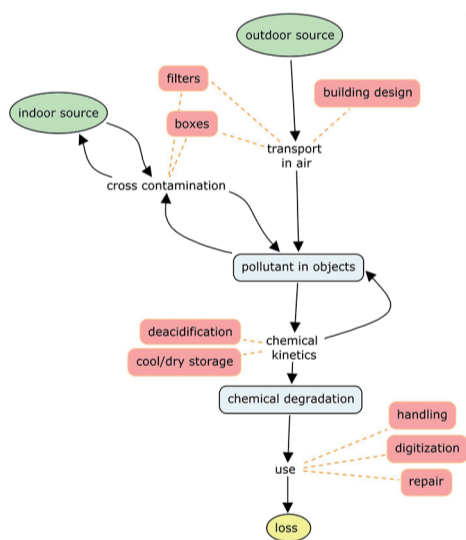


Pollution Pathway – A new method to quantify effects and costs of the reduction of air pollution in libraries and archives

Abstract In this project we will develop a new method to perform a risk assessment analysis for the single agent indoor air pollution focussed on mitigation measures and we will apply it to two major Swiss paper-based institutions, the Swiss National Library and the Library of Geneva. Our work originated from the need of understanding if the use of gas filters in libraries and archives and the resulting reduction of paper degradation is worth the investment of initial installation, maintenance and energy consumption of the filters. Beside filters, paper-based institutions can apply alternative measures. These measures may not target pollution directly but contribute to the reduction of its effects. Examples are: the practice of not opening windows in depots, the use of archival boxes, mass de-acidification, and digitization of paper items. The question we want to answer is how these alternative measures compare with the use of gas filters considering their efficiency and cost. To answer this question we have developed a new method, which we call the Pollution Pathway Method.



A simplified version of the Pollution Pathway Diagram.

We want to compare the efficiency and costs of different measures paper-based institutions have in place to reduce the effects of indoor pollution. One difficulty encountered when comparing different measures is that they are applied at very different levels within the institutions. The solution to this difficulty is provided by comparing their estimated reduction effect on the loss of collection value. The loss of collection value is the loss of future possibility to use the collection.

The Pollution Pathway Diagram The next challenge is how to connect systematically reduction measures to the loss of collection value. We observe that pollutants are first transported in air from their source to the collection, then they react within the paper to give a chemically degraded object and finally it is the use of the object which leads to loss of value. Along this chain of mechanisms each institution has in place a number of mitigation measures. An effective way to describe and connect them systematically is to represent this chain of causal mechanisms in a diagram, which we call Pollution Pathway Diagram (Figure 1), joining pollution sources to loss of value and to insert reduction measures as barriers along the chain.

In the first phase of the project we will design the Pollution Pathway Diagram for two repositories in the partner institutions.

The mathematical model The diagram is the visual representation but the core of the method is a mathematical model describing

the mechanisms of transport of pollutants in air, chemical reactions in the paper and use of objects.

The mathematical description of all the branches of the Pollution Pathway Diagram is far too complex and at the same time not necessary. The challenge is to select which parts in the diagram mostly influence the loss of value of the collection. As the indoor concentration of pollutants generated by the paper collection itself is two orders of magnitude larger than the concentration of outdoor generated pollutants, a key part of the diagram is the modelling of the cross-contamination process. Preliminary results show that the effect of acetic acid, a gas generated during the degradation of paper and generally considered a key pollutant, is negligible.

Calculation of the loss of value and comparison among different reduction measures. The calculation of the loss of value of the collection in the specific institutions involves on one side the assessment of the efficiency of the measures located on the most relevant branches (determined through collection of data like e.g. pollution levels and pH distribution in the collection) and on the other side the determination of the relevant values for the collection. The effect of the efficiency and costs of the mitigation measures located on the main branches on the collection loss of value will finally allow to compare e.g. the chemical filter option with the other options present in the institution.

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