Indoor air quality at the BnF

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- Michel Brarda-Wieber (Puratech, France)
Corrosion on Hiross dehumidifiers/humidifiers
Types of corrosion

Cold pipes:

• *formicary* corrosion (« ant-nest » corrosion)

Hot pipes:

• *sulfur* corrosion on copper–phosphore silver brazed joints
• no corrosion observed on copper – phosphore brazed joints
Target 2005 : phase 1

Situation and state : quantification and characterization of the pollutants responsible for the corrosion :

- Corrosion monitoring of the environments
- Collecting pollutants
Sensors used

Electrical resistance (ERS)

Ag, Cu Coupons

Quartz cristal microbalance (QCM)

Passive sampling tubes

Nguyen Thi-Phuong IAQ Braunschweig 2006
Storage rooms chosen

The choice of the storage rooms was based on:

- The intensity of the corrosion observed on the Hiross unit
- The type of collection stored
Corrosion levels observed on Hiross units - Formicary : Level 0
Sulphur : Level 0
L1-28 : results obtained with QCM
Corrosion levels observed on Hiross units - Formicary: Level 3
Sulphur: Level 0
L4-34: results obtained with QCM

L4 34-QCM OnGuard CCT (Purafil)-Year 2005

- Cu corrosion
- Ag corrosion
- T°
- RH

Corrosion thickness (Angstrom Eq.)

Date:
Feb-05 Mar-05 Apr-05 May-05 Jun-05 Jul-05 Aug-05 Sep-05 Oct-05

Nguyen Thi-Phuong IAQ Braunschweig 2006
L1-34 : Newspapers in boxes

Corrosion levels observed on Hiross units -
Formicary : Level 3
Sulphur : Level 3

Nguyen Thi-Phuong IAQ Braunschweig 2006
L1-34 : results obtained with QCM

L1 34-QCM OnGuard CCT (Purafil)-Year 2005

- Cu corrosion
- Ag corrosion
- T°
- RH

Corrosion thickness (Angstrom Eq.)

Date

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L1-40 : Magazines in boxes

Corrosion levels observed on Hiross units - Formicary : Level 2
Sulphur : Level 3
L1-40 : results obtained with QCM

L1 40-QCM OnGuard CCT (Purafil)-Year 2005

Corrosion thickness (Angstrom Eq.)

Cu cumulé
Ag corrosion
T°
RH

Date
Nov-04 Dec-04 Feb-06 Mar-06 May-06 Jun-06 Aug-06 Sep-05 Oct-05

Nguyen Thi-Phuong IAQ Braunschweig 2006
QCM results compiling

QCM Copper-Year 2005

QCM Silver-Year 2005

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QCM results, influence of RH

- Cu sensitive to RH variations
- Ag less sensitive to RH variations
Ag corrosion – SEM EDS analysis

Ag$_2$S crystals
Conclusion 1

Obvious indoor pollutants emitted by the collections and conditioning boxes:

- Sulphur pollution = boxes?
- Acidic pollution = acidic books?
Indoor air corrosivity sometimes higher than outdoor
Comparison with ISO 11844

Classification of low corrosivity of indoor atmospheres -- Part 1: Determination and estimation of indoor corrosivity

Nguyen Thi-Phuong IAQ Braunschweig 2006
Air filtration systems

- Volume of a storage room: 2,500 m³
- Air exchange rate: 4 vol./hour
- Air recycling rate (not filtered): 90%

Conclusion: high indoor pollutants concentrations due to the absence of filtration of the recycled air.
## VOC’s analysis

<table>
<thead>
<tr>
<th>µg/m3</th>
<th>L1-28 Audiovisuel items</th>
<th>L1-40 Magazines in boxes</th>
<th>L1-34 19th newspapers in boxes</th>
<th>L4-34 19th and 20th books</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde</td>
<td>9,8 µg/m3</td>
<td>17,7</td>
<td>18,6</td>
<td>17,3</td>
</tr>
<tr>
<td>hexaldehyde</td>
<td>8,8</td>
<td>41,9</td>
<td>26</td>
<td>10,1</td>
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<tr>
<td>hexanal</td>
<td>2,3</td>
<td>13,2</td>
<td>8,7</td>
<td>2,7</td>
</tr>
<tr>
<td>Alcanes</td>
<td>12,1</td>
<td>1,4</td>
<td>1,7</td>
<td>1,0</td>
</tr>
<tr>
<td>Toluene</td>
<td>44,8</td>
<td>7,9</td>
<td>3,0</td>
<td>7,4</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>&lt;10</td>
<td>33</td>
<td>34</td>
<td>24</td>
</tr>
<tr>
<td>Formic acid</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Sulfuric acid, hydrogen sulfide</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>
Comparison with ISO 11799

ISO 11799: Information and documentation. Document storage requirements for archive and library materials
Conclusion

• Indoor VOC’s shall be taken into account

• Conception of air purification systems for archives and libraries shall be specified in standards

• VOC’s emitted by the materials used for conditioning shall be specified in standards ➔ protocols for quality control of preservation materials shall be developed
Aknowledgements

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