Screening questionnaire for selection of sampling sites for assessment of risks from combined exposure to multiple chemicals in indoor air

Supplementary publication to the screening tool for assessment of health risks from combined exposure to multiple chemicals in indoor air in public settings for children
Abstract
This screening questionnaire was developed to facilitate the selection of sampling sites for assessment of risks from combined exposure to multiple chemicals in indoor air in public settings for children. It addresses indoor and outdoor factors relevant to indoor air pollution, and uses a simplified approach to answering questions (yes/no). Public-health workers can use the questionnaire to select sampling sites in schools, kindergartens and day-care centres where indoor air pollution is a concern.
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BACKGROUND

Assessment of exposure to chemicals in indoor air is needed to assess risks from individual chemicals as well as combined exposure to multiple chemicals (1,2). Information about the concentrations of specific chemicals can be obtained from indoor air quality monitoring programmes at national, regional or local levels, as well as from dedicated projects. Since it is unfeasible to sample and analyse chemicals in indoor air in all buildings and rooms, sampling sites need be selected and prioritized. Several examples of approaches to selecting sampling sites are available from scientific studies and projects at both European and national levels (3,4).

Different types of questionnaires have been used in international projects, such as the Schools Indoor Pollution and Health Observatory Network in Europe (SINPHONIE) project (3), and in national projects. For example, starting from 1990, Finland developed a range of indoor air quality assessment questionnaires, including for occupants of workplaces and schools (the MM-40 questionnaire), pupils in secondary schools (MM-60), and parents of primary-school children (MM-80) (4). These questionnaires were used in the framework of the ARIA project conducted in Porto, Portugal, which aimed at characterizing indoor environments and studying links between sources of exposure, chemical concentrations and health effects (5).

In general, locations where higher concentrations of hazardous chemicals in indoor air are anticipated due to different conditions are of particular interest. These concentrations depend upon many factors, including levels of outdoor air pollutants that penetrate indoor spaces, releases from indoor sources and human activities, and the rate of exchange between indoor and outdoor air (6–8).

Outdoor air pollutants penetrate buildings through windows, doors, ventilation systems or gaps in building structures. The higher the concentration of outdoor air pollution from, for example, high-traffic roads, industrial enterprises, small workshops or pesticide application, the higher the expected concentration of chemicals in indoor air. The penetration of outdoor air pollutants into indoor spaces also depends on other factors, including the presence of green spaces, artificial barriers such as other buildings and prevailing wind directions (6–8).

Many indoor sources of chemicals can also affect air quality. These include building materials, furniture, electronic equipment, cleaning products, and human activities that use chemicals and chemical products (9–11). Depending on the combination of these factors and conditions, levels of indoor air pollution can differ significantly.
This document includes a screening questionnaire developed to facilitate the selection of sampling sites for conducting risk assessments of indoor air pollution. Public-health workers can use the questionnaire to select sampling sites in schools, kindergartens and day-care centres where indoor air pollution is a concern.

Scientific information on sources of chemicals in indoor air and factors influencing levels of pollution were considered throughout the questionnaire’s development. A draft version was discussed during two expert consultations held in Bonn, Germany, in December 2018 (12) and September 2019 (13). The draft questionnaire was piloted during trainings in Budapest, Hungary, in May 2019 and Tallinn, Estonia, in October 2019, and was finalized at a fourth expert consultation held virtually in November 2020 (14).
HOW TO USE THE SCREENING QUESTIONNAIRE

The questionnaire can be filled in onsite based on visual inspection. Additional information on location, building materials, furniture and other potential sources of chemicals, collected through consultation with the facility’s administration, can complement visual assessments.

The questionnaire is divided into three sections:

♦ Section 1: Selection of buildings: outdoor factors of relevance to the pollution of indoor air by chemicals;
♦ Section 2: Selection of room(s): indoor sources of chemicals; and
♦ Section 3: Other factors.

Questions are compiled with the assumption that users will first select buildings of potential concern for indoor air pollution, and then select specific rooms/places in those buildings. When answering the questions, please insert your answer in the free space on the right side, as demonstrated in Fig. 1.

Fig. 1. Example answer in the screening questionnaire

| Are there any industrial facilities, high-traffic roads or agricultural lands treated with pesticides or other pollution sources near the facility? | Yes – 1 | No – 0 | 1 |
|---|---|---|

Once you have answered all the questions, calculate the total score. The higher the score, the higher the likelihood of indoor air pollution by chemicals. If the score in different places is the same and you must select a single site among them, consider your answers to questions on the following factors:

♦ proximity to industrial facilities, high-traffic roads or agricultural lands treated with pesticides (Section 1, questions 4, 5 and 6);
♦ time since renovations/repairs and the installation of new furniture (Section 2, questions 1 and 2); and
♦ complaints made by teachers, pupils or parents about the indoor environment (smell, irritation symptoms, etc.) within the past year (Section 3, Question 9).

Instructions in the questionnaire will also guide you.
## SCREENING QUESTIONNAIRE

### SECTION 1.
Selection of buildings: outdoor factors of relevance to the pollution of indoor air by chemicals

1. Please provide **general information** about the facility for children.
   - Address, including city and country:
   - Type of facility (school, kindergarten, day-care centre, other):
   - Working hours (from xx to xx):
   - Year of the building's construction/major renovation:

2. What kind of **area** is the facility located in? Please circle the most appropriate answer.
   - Rural
   - Urban, within built environment
   - Urban, surrounded by green spaces

3. Was the building **constructed/renovated** within the past 3 months? Yes – 1 No – 0

4. Are there any **industrial facilities, high-traffic roads or agricultural lands treated with pesticides** (or other pollution sources) near the facility? Yes – 1 No – 0
   - High-traffic road (less than 100 m)
   - Parking place (including idling) (less than 100 m)
   - Gasoline station (less than 50 m)
   - Power plant (less than 500 m)
   - Waste management plant (less than 500 m)
   - Chemical or metallurgic plant (less than 500 m)
   - Agricultural activity using pesticides (less than 50 m)

5. Is the facility **located** leeward (downwind) in relation to these sources of chemicals? Yes – 1 No – 0

6. Is there a **green zone** around the facility or between the facility and possible sources of chemicals? Yes – 0 No – 1

7. Is the facility’s **heating system** centralized? Yes – 0 No – 1

8. Does the heating system use **clean fuel** (natural gas, electricity)? Yes – 0 No – 1

<table>
<thead>
<tr>
<th>Total score for Section 1</th>
</tr>
</thead>
</table>

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1 For the purpose of this questionnaire, “green zone” refers to trees, shrubs and vegetation that form a buffer or barrier to airborne pollutants.
### SECTION 2.
Selection of room(s): indoor sources of chemicals

| 1. Has the room been **renovated**\(^2\) within the past 2 months? | Yes – 1 | No – 0 |
| 2. Has new **furniture** been installed within the past 6 months? | Yes – 1 | No – 0 |
| 3. Is the material used for the **floor covering** labelled “low-emission”? Please do not answer if you are unsure or if this information is not available. If there is no answer or the answer is “No”, please specify the type of material below. | Yes – 0 | No – 1 |
| - Ceramic, stone | Yes – 0 |
| - Natural wood | Yes – 0 |
| - Laminate | Yes – 1 |
| - Rubber | Yes – 1 |
| - Wall-to-wall carpet | Yes – 1 |
| - Linoleum | Yes – 1 |
| - Polyvinyl chloride (PVC) | Yes – 1 |
| 4. Is the material used for the **wall coating/covering** labelled “low-emission”? Please do not answer if you are unsure or if this information is not available. If there is no answer or the answer is “No”, please specify the type of material below. | Yes – 0 | No – 1 |
| - Water-based paint | Yes – 0 |
| - Solvent-based paint | Yes – 1 |
| - Oil-based paint | Yes – 1 |
| - Paper-based wallpaper | Yes – 0 |
| - Textile-based wallpaper | Yes – 1 |
| - PVC-based wallpaper | Yes – 1 |
| - Tiles | Yes – 0 |
| - Natural wood | Yes – 0 |
| - Wood veneer/plywood | Yes – 1 |

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\(^2\) For the purpose of this questionnaire, “renovated” means renewed by repairing or rebuilding.

\(^3\) Several systems of labelling for low-emission products have been developed at the European level as well as the national level (for example, in Germany, France).
5. Is the material used for the **ceiling coating/covering** labelled “low-emission”? Please do not answer if you are unsure or if this information is not available. If there is no answer or the answer is “No”, please specify below what type of material is used.

<table>
<thead>
<tr>
<th>Material</th>
<th>Yes – 0</th>
<th>No – 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whitewash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paint (acrylic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gypsum, plaster</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood veneer/plywood</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. What materials are used for the **furniture**? Please specify below.

<table>
<thead>
<tr>
<th>Material</th>
<th>Yes – 0</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood veneer/plywood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic composite furniture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. What materials are used for the **window frames**? Please specify below.

<table>
<thead>
<tr>
<th>Material</th>
<th>Yes – 0</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. What materials are used for the **curtains/sun blinds**? Please specify below.

<table>
<thead>
<tr>
<th>Material</th>
<th>Yes – 0</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural wood (if treated with flame retardants)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treated fabric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthetic material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No curtains/sun blinds</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total score for Section 2**
### SECTION 3. Other factors

1. What type of **ventilation system** is used? Please specify below.
   - Manual window-opening only: Yes – 1
   - A mechanical ventilation system only: Yes – 1
   - A hybrid of manual and mechanical ventilation: Yes – 0

2. Is there **electronic equipment** in the room (computers, tablets, virtual blackboards, etc.)?  
   Yes – 1  No – 0

3. Do you notice (or have you noticed in the past) an unusual/chemical **odour** in the room?  
   Yes – 1  No – 0

4. How often is the room **cleaned without chemical products** (wet mopping/wiping or vacuuming of flooring and furniture)? Please specify below.
   - Once or twice a day: Yes – 0
   - Less than once a day: Yes – 1

5. When is **cleaning without chemical products** (wet mopping/wiping or vacuuming of flooring and furniture) commonly done? Please specify below.
   - Before classes: Yes – 0
   - During classes: Yes – 0
   - After classes: Yes – 1

6. When is **cleaning using cleaning products** commonly done? Please specify below.
   - Before classes: Yes – 1
   - During classes: Yes – 1
   - After classes: Yes – 0

7. Are the **cleaning products** used for maintenance and cleaning in the classrooms labelled “free from toxic chemicals” or “eco-friendly”? Please do not answer if you are unsure or if this information is not available.  
   Yes – 0  No – 1

8. Is the room used for **other activities** after class hours (during evenings or weekends)?  
   Yes – 1  No – 0

9. Have teachers, pupils or parents made any **complaints** about the indoor environment (smell, irritation symptoms, etc.) within the last year?  
   Yes – 1  No – 0

10. Are there any signs of **mould** in the room(s)?  
    Yes – 1  No – 0

11. Are there any signs of **humidity** in the room(s)?  
    Yes – 1  No – 0

12. Are there any signs of **pests** in the room(s)?  
    Yes – 1  No – 0

13. Are **air fresheners** used in the room(s)?  
    Yes – 1  No – 0

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**Total score for Section 3**

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**TOTAL SCORE FOR THE QUESTIONNAIRE**

Combined scores of sections 1, 2 and 3
REFERENCES


The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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