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Report on a Swiss Project on the Emission Characteristics of Indoor Materials

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Introduction

Energy saving measures with reduced outdoor air change rates may lead to critical indoor air contaminant concentrations.

Emission characteristics of construction materials and products play an important role.

Therefore a project has been set up at EMPA to investigate emission characteristics of such materials using test chambers.

Description of the project

Scope:

An increase of indoor air contaminant levels has been observed within buildings due to the two following reasons:

1. Buildings are air-tightened for energy efficiency

2. Increased use of contaminant emmissioning materials as indoor construction and room equipment materials.

Due to this facts, concentrations of volatile organic CH-compounds higher than in the outdoor air are measured within residential and office buildings.

Data and guidelines on the applicability of such materials are therefore needed.

Standardized test procedures including guidelines, practical to and accepted by the industry, exist in Switzerland only for the formaldehyde emmissions of chip boards (DIN EN 120).

Generally, for the testing of the emmission chracteristics of construction materials, many different methods are used. They can be classified into :

1. Methods which measure the quantity of emmitted contaminants, like:

   - Head-space analysis
   - Test in test chambres

and

2. Methods which measure the emmittable amount of contaminants:

   - Solvent extraction
   - Vacuum extraction

A direct statement on the contaminant concentration to be expected in a particular room can be given only using test chambers.
Otherwise, comparative studies must be performed in each case.

The use of small environmental test chambers to develop emmission characteristics of materials is still evolving.
Modifications and variation in equipment, test procedures and data analysis are still common. The goal is therefore to establish generally applicable means to evaluate and characterize such materials.

Goals of the project:

1. Set up of the knowledge about the emission characteristics of typical construction materials under realistic conditions

2. Set up of the knowledge on the parameters which influence these emissions and their respective importance.

3. Development of a generally applicable standard test procedure for the determination of the emission characteristics.

Work plan:

Set up of measuring sites:

- Planning, installation and testing of two test cells, namely:

  1) A 1 m^3 test cell for emission factor determination

  2) A 20 m^3 test chamber as a modell for a living room for the evaluation of the indoor air contamination.

Contaminant emission:

- Determination and evaluation of the contaminant emission of typical construction material.

- Determination of the importance of factors influencing this emissions, as:

  Environment related parameters:
  Temperature, humidity, air change rate, air velocities
  Specimen related parameters:
  Aerea ratio (emitting aerea per test cell volume), aging effects

- Quantification of the influence of such parameter.

- Checking of the transferability of the emission factors for different test cell volumes.

Test procedure:

- Development and verification of a practical and reliable test procedure for the determination of the emission characteristics of building materials.

Project Delimitations

The following related topics are not covered by this project:

- Field survey on indoor air contaminant levels.
  This topic is covered by a project on the analysis of organic contaminants in residential buildings, performed at the ETH-Zuerich(Institut für Toxikologie) and the University of Zuerich.

- Characterization of indoor air quality using Fanger's methods.

- Determination of the contaminant absorption characteristics of building construction materials.

Schedule:

1989:	Literature survey Set up of relations to COST,CEN,AIVC,SIA Planning and set up of test cell Test planning
1990:	Testing of the two test cells Performance of emission characterization tests Development of test standards
1991:	Testing and Verification of the standard test procedure Reporting and dissemination of results

Working Report 1989:

Test cells:

The 20 m^3 chamber was set up in Oct 89 and tested in spring 90
The 1 m^3 test cell was set up in spring 90 and was tested after that.

Planning of the emission tests:

Material selection: Materials were grouped as follows:

1. Coatings, paints, glues and adhesives
2. Covers (carpets, linoleum, cork panels)
3. Timber and wood-based materials (e.g. chipboards)
4. Insulation material

Two cases in the time domain are considered, especially for materials of group 1:

A. Short term emission characteristics, typical for the time period when the materials just have been applied or painted.

B. Long term emission characteristics

Project relations:

COST action 613 'Indoor air quality and human effects': Participation in the group on 'Organic Emissions'.

Set up of relations to multizone air flow modeling groups, for:
- The definition of realistic outdoor air change rates
- The evaluation of possible future projects on the development of ventilation strategies for:
  Critical short time period cases (when e.g. applying or painting organic solvent emitting materials)
  Critical long term cases.

References:

[1]:Bruce a. Tichenor: *Indoor Air Sources: Using small environmental test chambers to characterize organic emissions from indoor materials and products.*
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