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MEASUREMENT OF VOC EMISSIONS FROM WOOD REMEDIAL TREATMENT: CHAMBER TESTS AND FIELD EXPERIMENTS

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SUMMARY

The emissions of two wood remedial treatment products (water-based WB and petroleum-based PB solvent formulations) were characterized by two laboratories (CSTB and CTBA) using emission test chambers. VOC emissions were also measured in real conditions during a roof renovation work in an old building. Identified VOC and emission patterns in test chambers and on the field were comparable. Emission models were used to estimate the time before re-entry in the treated space.

CHAMBER TESTS

- Test conditions are selected according to the ENV 13419-1 standard (23 ± 2 °C, 50 ± 5% RH, q = 1.5 $m^3.h^{-1}.m^{-2}$).
- WB or PB wood preservative product is applied on spruce tree boards with a paintbrush (300 $ml.m^{-2}$).

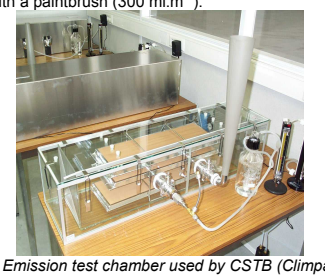

Figure 1. Emission test chamber used by CSTB (Climpaq, 50 L)

FIELD EXPERIMENT

- Renovation of an old building (oak frame)
- Spray and injection of PB wood preservative product is realized by a professional (300 $ml.m^{-2}$)
- Specific ventilation rate q = 15.4 $m^3.h^{-1}.m^{-2}$

Figure 2. Roof trussing before renovation (total wood surface 84 m^2, volume 65 m^3).

CHAMBER RESULTS

Emissions from **WB solvent** are characterized by propylene glycol ethers (mainly 1-methoxy-2-propanol).

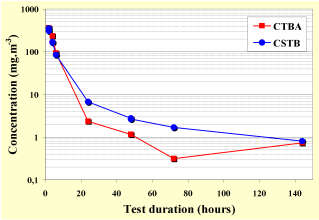

Figure 3. Water-based wood preservative (1-Methoxy-2-propanol concentrations)

Emissions from **PB solvent** are characterized by alkanes (mainly C12 and C13). Aromatic and cyclic hydrocarbons are also detected.

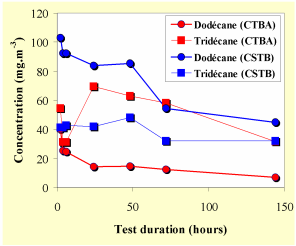

Figure 4. Petroleum-based wood preservative (Main alkanes concentrations)

FIELD RESULTS

VOC emissions from the PB wood preservative on the field are identical than those detected in chamber tests.

TVOC field measurements are compared with exposition concentrations predicted from chamber tests. Predicted exposition concentrations are slightly higher than field measurements (less than one order of magnitude).

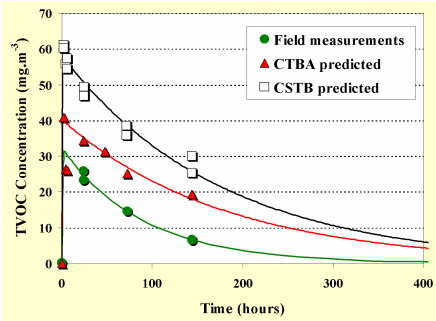

Figure 5. TVOC exposition concentrations predicted from chamber tests and measured on the field.

DISCUSSION

- For both WB and PB wood preservative products, a **good agreement** is found between results from CSTB and CTBA.
  Differences in test specimen preparation explain the higher TVOC emission found by CSTB (variation in the initial VOC load).
- Differences between field and chamber tests are probably due to two main causes :
  - **Variations in product application** (spray and injection versus paintbrush).
  - **Field environmental conditions** : high ventilation (20 ach) and fluctuations of temperature and humidity.
- Time before re-entry in the treated space is estimated using a simple dilution model. The field experiment show the lowest values :
  - **21 days** to reach initial TVOC concentration before treatment (0.12 $mg{\cdot}m^{-3}$)
  - **3 days** to reach a non-professional exposure limit proposed for white-spirits (14.4 $mg{\cdot}m^{-3}$)

These estimated values are strongly related to the air exchange rate, e.g., for 1 ach, the time needed before re-entry is increased by more than 10 days in both cases.

Chamber emission tests are efficient to characterize VOC emission from solvent-based products, and therefore to determine the potential health impact on the exposed population. The satisfactory comparison between chamber test and field results allows a reliable use of decay models in order to predict the time before re-entry under different application or ventilation scenario. Improvement of liquid product application control and environmental parameters input in the models would however increase the reliability of the simulation.

ACKNOWLEDGEMENTS

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