



Research & Development Highlights

Technical Series
91-205

Air Tightness, Air Movement and Indoor Air Quality in Quebec High-Rise Apartment Buildings

Introduction

In many high-rise apartment buildings, the main source of ventilation is air leakage through exterior walls, between units, and to and from service chases. Excessive air leakage can lead to moisture problems, poor indoor air quality, excessive heating costs, and occupant discomfort. Complaints about temperature fluctuations and smells are common.

Little is known about actual air change rates, pollution levels, or the incidence of leakage through exterior walls. To rectify this situation, Canada Mortgage and Housing Corporation (CMHC) commissioned a study of air tightness, air movement, and indoor air quality in two Montreal high-rise apartment buildings.

Test Program

Building 1 was constructed in 1991. Each unit has electric baseboard heating, plus an air conditioning unit that serves all of the rooms. The windows are of high quality, and electrical outlets on the exterior walls are carefully sealed.

Building 2 was built in 1960. The heating system consists of two central fuel-fired boilers with a hydronic system distributing heat to each unit. The windows and balcony doors are the original installed ones.

The study consisted of three phases: an air leakage study, a survey of potential indoor air quality problems, and an analysis of chemical and biological pollutants.

Air Leakage Study

The air leakage study revealed a high level of air leakage, largely exceeding the maximum levels recommended by the National Research Council of Canada.

Pressure differential	Leakage rate (1/s-m ²)		
	Building 1	Building 2	Recommendation
25Pa	1.34	2.79	0.05
50Pa	2.20	4.58	0.10
75Pa	3.01	6.12	0.15

Modifications which could reduce this leakage rate are suggested. The openings around the electrical connections for the baseboard heaters in Building 1 could be sealed. The walls and windows in this building are sufficiently air tight. In Building 2, the doors and windows should be replaced, as they are no longer air tight.

Air Quality Survey

The air quality survey involved all the mechanical rooms and several apartment units in each building. This survey identified areas requiring more extensive analysis. It also noted problems which could affect the comfort or well-being of the occupants.

In Building 1, several units were still being decorated, leading to paint and adhesive fumes.

There was a smell of gas in the lean-to, and the make-up air fan in the hallways was equipped with too small a filter for the opening. In Building 2, the outside fresh air intake was too close to ground level and to the garbage storage area.

No major problems were indicated by the survey of tenants and owners. All seemed satisfied with the comfort of their units.

Chemical and Biological Analysis

Suspected trouble spots identified in the air quality survey were analysed for several common pollutants: carbon monoxide, formaldehyde, ozone, nitrogen dioxide, nitric oxide, toluene, xylene and gasoline. Except for carbon monoxide, levels of all of these substances were too low to detect.

Where carbon monoxide was detected, the levels measured were well below maximum acceptable concentrations. The low pollutant levels are probably due to the buildings' high infiltration levels: any pollutants produced indoors are quickly diluted by the incoming fresh air.

Results of the microbial analyses were similar: concentrations of bacteria and moulds are low and present no health problem. Two minor problems were discovered. In Building 1, two types of penicillium not present in the outside air were detected in the test unit. Their presence

was probably the result of poor maintenance of the air conditioner. In Building 2, fusarium bacteria were detected in the laundry room. These could cause problems if allowed to develop.

Conclusion

The analysis carried out in these two high-rise apartments shows that all the occupants are comfortable and do not experience problems connected with the indoor air quality in their units. It should be pointed out that these two buildings had been very well maintained. The results might have been different if the study had taken place in lower quality, less well—maintained buildings.

Even so, it is reasonable to assume that the results of this study are applicable to the greater part of the high-rise housing stock.

See also:

Air lightness, Air Movement and Indoor Air Quality in British Columbia High-Rise Apartment Buildings (90-232).

Air lightness, Air Movement and Indoor Air Quality in Atlantic Region High-Rise Apartment Buildings (91-203).

Project Manager: Jacques Rousseau

Research Report: Enquête sur le terrain portant sur l'impact de l'air, le mouvement de l'air et la qualité de l'air intérieur des tours d'habitation au Québec

Research Consultant: CMA Chal-four, Marcotte et Associés Inc.

A full report on this research project is available from the Canadian Housing Information Centre at the address below.

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