Research & Development Highlights

96-203 Technical Series

MOLDS IN FINISHED BASEMENTS

Introduction

Research has shown a correlation between the presence of molds in indoor air and human health. It is now known that certain molds are toxic while others are pathogenic to humans. These findings are the impetus behind recent CMHC initiatives to further investigate the presence mold in houses. The first project includes mold sampling and occupant health testing in Wallaceburg, Ontario. The second project, discussed here, is a survey of finished basements in the Ottawa-Carleton region for the presence of molds in the basement wall cavity.

The initial phase of this survey was conducted between January and March *1995* to determine the extent of moisture problems in the semi-finished portions of *405* basements. The investigation included such variables as ambient temperature, interior relative humidity, house age, foundation type, floor and wall finishes, wall insulation, air/vapour barrier, and wall-framing size as well as humidifier, air conditioner, HRV or surnp pump use.

Results from this survey revealed that moisture problems were not usually related to the interior relative humidity but rather to localized issues such as local geomorphology, downspout location, window well flooding, cracks or leaks in the foundation, plumbing problems, and grading problems. Relative humidity was influenced by factors such as recent shower activity, hanging laundry or venting the dryer in the basement, and wood stove use. Ventilation devices and high humidifier settings as high as 60% in some cases also had large effects.

Research Program

The second phase of this research involved a detailed study of 27 houses for the identification of molds in finished basement wall cavities. The project, conducted between October and December of *1995*, examined basement conditions and construction practices in an effort to determine possible correlations between the presence of mold and finishing types.

Two assumptions were made for the project. Evidence of previous mold growth could be present even if the condition did not exist at this time. Indoor air could be affected by molds in the wall cavity since the cavities were open to the interior basement at various locations. This second assumption was confirmed by observations of air movement through cavity openings.

It was determined that two approaches should be used for mold sampling. Swab samples were used to identify viable spores that could readily be cultured. Non-viable spores were identified microscopically via a cellophane tape sampling procedure. An optical fibrescope was used to inspect the wall cavity.

The 27 houses were chosen out of a 200 house volunteer pool from the initial survey. These houses were chosen based on a number of criteria including the presence or absence of moisture problems, use of full height and half height insulation, basement finishing types, foundation types, and age.

Wood moisture readings were taken from exposed floor joists and studs at *5* locations in each basement. Internal and external relative humidity and temperature measurements were taken. Humidity readings were used as a basis of comparison with wood moisture contents to determine if a correlation exists. Wood temperatures and moisture readings were also taken at the cavity sampling location. See the sample house data below.

House ID	M15
Date of visit	Dec. 5195
Year Built	1988
Year Bsmt. finished	1988
Exterior cond's	
Time of Day	9:00 AM
Temp. °C	-14
Rd. Hum. %	80
Interior Cond's	
MainFlrTemp°C	17.8
Main Fir RH %	33
Room data taken	living room
Bsmt Finished	
Area	17.4
Temp. °C	
Rd. Hum. %	
Temp. °C	*17.5*
Rel. Hum. %	30.1
Room data taken	furnace room

Basement Exposed Wood Moisture Readings Area Component

		Temp.	WMR
1. tin	joist	14.2	<6
2. unfin.	joist	15	<6
3. fin	joist	15.7	<6
4. fin	*step*	*15.9*	*7.8*
5. unfin	*strap*	*18.8*	*7*

Basement Wall/Floor Cavity Conditions

	Location	W/F Cavity Temp	WMR	Corrected MC
1	wall 14.2	>30 above 28		
2	wall	11.7	7	10.3
3	wall	2	6	approx. 11.0
4	wall	8.6	11	17.1
5	- -	-		

Molds Found

# of Species Identified3
Considered Toxigenic1

Homeowner recollections of moisture problem areas were used to select wall cavity sampling locations. Other locations were chosen based on interior inspection and exterior observations such as localized grading problems, downspout location, or foundation cracks. Where possible, cavity inspection and sampling were conducted at electrical outlet openings, otherwise a 75 cm by *50* cm hole was made through the drywall.

Findings

Of the 27 houses tested, 16 had visible signs of molds present in the wall cavity. Note that in several of the houses identified as "moisture-troubled" there were no molds found. Several houses chosen as "untroubled" did indeed have molds when closely inspected. Toxigenic or dangerous molds were found in 15 of these houses while pathogenic mold was identified in the 16th house. An investigation into possible health impacts is beyond the scope of this study.

Mold and moisture identification was difficult to correlate with construction practices due to the wide range of house ages, construction, insulation, and finishing details. As found in the earlier survey of moisture problems, the largest common factor in all moldy basements was the presence of moisture sources or repeated or prolonged wetting incidents.

Mold was not found in either of houses constructed with full insulated basements as required current Ontario building code.

Mold growth was observed on the building paper moisture barrier in two houses. In one case the building paper was fitted between the original studs to the full depth below grade, against the foundation wall. In the second case the moisture barrier was under the sleepered floor.

One interesting observation was that basements with half height insulation permitted the water from leaks or window well flooding to drain out of the finished area which prevented mold growth.

Mold growth was identified in 9 of 18 houses that had baseboards in the basement. This is likely due to baseboards acting as an inhibitor to drying of wet interior finishes.

Moisture retention was discovered in cavities plagued by spalling problems and continued water leakage. This trapped moisture led to cavity mold problems and, in one case, soaked the interior paneling.

Localized mold growth could be found in areas where drywall came in contact with the floor slab due to the double effect of moisture wicking from the floor slab and the drywall temperature dropping below the dewpoint.

Correlation was found between wood moisture readings and long term relative humidity in the room.

Implications for the Housing Industry

- The presence of toxic and pathogenic molds in basement wall cavities is a common occurrence and requires ongoing attention by individuals in the fields of health and building sciences.

  - The toxic mold stachybotrys atra was detected in several houses via the cellophane tape sampling method. As some colonies were not active, they would not have been identified through the commonly used swab sampling procedure.

  - Mold growth in the basement is predominantly influenced by chronic moisture problems, such as window well leakage, rather than wall finishing practices.

  - With these findings in mind, greater attention must be paid to foundation dampproofing, grading problems, adequate on-lot drainage systems, and areas of moisture ingress. Failure to do so can lead not only to mold problems but also basement assembly and performance problems.

Project Manager: Don Fugler

Research Report: Molds in Finished Basements (1996)
Research Consultant: Scanada Consultants

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

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