RESEARCH REPORT

PRESERVED WOOD FOUNDATION WALL CAVITY ARSENIC AND MOLD STUDY

EXTERNAL RESEARCH PROGRAM

Canada

CMHC SCHL
HOME TO CANADIANS

CMHC—HOME TO CANADIANS

Canada Mortgage and Housing Corporation (CMHC) is the Government of Canada's national housing agency. We help Canadians gain access to a wide choice of quality, affordable homes.

Our mortgage loan insurance program has helped many Canadians realize their dream of owning a home. We provide financial assistance to help Canadians most in need to gain access to safe, affordable housing. Through our research, we encourage innovation in housing design and technology, community planning, housing choice and finance. We also work in partnership with industry and other Team Canada members to sell Canadian products and expertise in foreign markets, thereby creating jobs for Canadians here at home.

We offer a wide variety of information products to consumers and the housing industry to help them make informed purchasing and business decisions. With Canada's most comprehensive selection of information about housing and homes, we are Canada's largest publisher of housing information.

In everything that we do, we are helping to improve the quality of life for Canadians in communities across this country. We are helping Canadians live in safe, secure homes. CMHC is home to Canadians.

You can also reach us by phone at 1 800 668-2642
(outside Canada call 613 748-2003)
By fax at 1 800 245-9274
(outside Canada 613 748-2016)

To reach us online, visit our home page at www.cmhc.ca

Canada Mortgage and Housing Corporation supports the Government of Canada policy on access to information for people with disabilities. If you wish to obtain this publication in alternative formats, call 1 800 668-2642.

PRESERVED WOOD FOUNDATION

WALL CAVITY ARSENIC AND MOLD STUDY

For

Canada Mortgage and Housing Corporation

By

Figley Consulting Associates Ltd.
Saskatoon, SK

This project was funded by Canada Mortgage and Housing Corporation (CMHC) under the terms of the External Research Program, but the views expressed are the personal views of the author(s) and do not represent the official views of CMHC.

August 30, 2004

TABLE OF CONTENTS

Executive Summary …… ii
Abstract ……iii

1.0 Background …… 1
2.0 Introduction …… 1
3.0 Investigation Protocol – Overview …… 1
3.1 Test Methodology for Airborne Arsenic Concentration ……. 2
3.2 Test Methodology for Airborne Fungi …… 3
3.3 Test Methodology for Wall Cavity Temperature and Relative Humidity …….. 3
4.0 Results …… 4
4.1 General House Information …… 4
Table 1. General House Information …… 5

4.2 Airborne Arsenic, Temperature and Relative Humidity Test Data …….. 6
Table 2. Airborne Arsenic Concentrations, Temperature and Relative Humidity in Wall Cavities …….. 6
4.3 Total Airborne Fungi Concentrations in Wall Cavities …… 8
Table 3. Total Airborne Fungi Concentrations in Wall Cavities ……..… 8
5.0 Discussion ……... 10
5.1 Genera,l …….. 10
5.2 Arsenic …….. 11
5.3 Fungi …… 11
6.0 Summary ……..13

Executive Summary

Chromated Copper Arsenate (CCA) and Ammoniacal Copper Arsenate (ACA) are compounds that were widely used to pressure treat wood intended for use in building foundations. The potential for these preservative chemicals to be released from the treated wood products and enter the indoor environment resulted in the need for research on their long-term field performance.

Preserved wood foundations (PWFs) also represent a potential source of fungal contamination. Although the wood products used in PWFs are more resistant to mold colonization, the long-term resistance to fungal growth within the wall assemblies under real-life use has not been extensively studied.

The potential for arsenic and mold to be present within the enclosed stud cavities of PWFs led to the development of this project. The objective of the project was to conduct a field study to determine the airborne arsenic and fungi concentrations in the wall cavities of ten houses in Saskatchewan that were constructed with pressure treated wood foundations.

The study examined ten different residential foundations of various ages and configurations and involved field tests for airborne fungi and airborne arsenic within the cavities of the foundation walls. In addition to the field monitoring study, an informal telephone survey was made to municipal building departments to solicit information regarding the distribution of PWFs within Saskatchewan.

At each of the three or four locations in each house, a small hole was drilled through the interior wall assembly and into the center of the insulated wall cavity, approximately five centimetres above the base plate. Probes were inserted into the cavity, and samples for airborne arsenic and total airborne fungi were collected.

The results of the testing showed that all of the airborne arsenic levels within the wall cavities were non-detectable or at trace levels. The highest measured concentration of arsenic was 0.00039 μg/L, which is only one twentieth of the Health Canada 05 Tolerable Concentration for this compound. The measurements did not indicate any significant release of arsenic from the preserved wood into the air within the interior of the enclosed wall cavities.

The measured fungi levels were highly variable. Some foundations showed no detectible indication of a mold source, whereas others showed significant evidence of mold growth within the wall cavity. Typically, the test locations that had observable signs of chronic wetting or moisture were moldy. However, some houses with no external signs of moisture problems had significant levels and types of fungi in the wall cavities. Overall, the visual condition of the foundations did not reliably reflect the measured levels of fungal contamination within the wall cavities.

Abstract

A field study was conducted to investigate the airborne concentrations of arsenic and total fungi in the finished exterior basement wall cavities in a group of ten houses constructed with pressure treated wood foundations (PWFs). The houses ranged in age from 18 to 26 years old and were located in various locations throughout the province of Saskatchewan, Canada.

Air samples were collected by drawing air from three or four different locations in the lower portions of the finished (insulated and sheeted) exterior wall cavities in each house. The air samples were analyzed for temperature, relative humidity, airborne arsenic concentration and total fungi concentration and fungi type. Physical observations of the general condition of the exterior and interior of the foundation walls were also collected.

The results from the study indicated that the airborne arsenic levels in the exterior wall cavities were very low. All of the measured arsenic concentrations were at or below 0.00039 ug/L. The airborne total fungi concentrations and fungi types were highly variable but frequently indicated the presence of fungal contaminant sources. The visual condition of the exterior and interior foundation walls was not a reliable predictor of the wall cavity airborne fungi characteristics.

Résumé analytique

L'étude menée sur le terrain visait à relever les concentrations aéroportées d'arsenic et la teneur totale en moisissure des cavités murales extérieures des murs de sous-sol finis dans un groupe de dix maisons reposant sur des fondations en bois traité (FBT). Les maisons, datant de 18 à 26 ans, se trouvaient disséminées en Saskatchewan, au Canada.

Des échantillons d'air ont été prélevés à trois ou quatre endroits différents des parties inférieures des cavités murales des murs extérieurs finis (comblées d'isolant et pourvues d'un revêtement intermédiaire). Les prélèvements d'air ont ensuite fait l'objet d'analyses quant à la température, à l'humidité relative, à la concentration d'arsenic aéroportée et à la concentration totale et au type de moisissure. Des observations de l'état général des parois intérieures et extérieures des murs de fondation ont également été recueillies.

Les résultats de l'étude indiquent que les niveaux d'arsenic aéroporté dans les cavités des murs extérieurs étaient très bas. Toutes les concentrations d'arsenic mesurées étaient égales ou inférieures à 0,00039µg/L. Les concentrations totales de moisissure aéroportée ainsi que les types de moisissures variaient grandement, mais révélaient fréquemment la présence de sources de contamination fongique. L'état des parois intérieures et extérieures des murs de fondation ne permettait pas de prédire avec fiabilité les caractéristiques de la moisissure aéroportée.

CMHC SCHL

National Office
700 Montreal Road
Ottawa ON K1A 0P7
Telephone: (613) 748-2000

Bureau national
700 chemin de Montréal
Ottawa ON K1A 0P7
Téléphone : (613) 748-2000

Puisqu'on prévoit une demande restreinte pour ce document de recherche, seul le résumé à été traduit.

La SCHL fera traduire le document si la demande le justifie.

Pour nous aider à déterminer si la demande justifie que ce rapport soit traduit en français, veuillez remplir la partie ci-dessous et la retourner à l'addresse suivante :

Centre canadien de documentation sur l'habitation
Société canadienne d'hypothèques et de logement
700, chemin de Montréal, bureau C1-200
Ottawa (Ontario)
K1A 0P7

Titre du rapport: _____

_____

Je préfèrerais que ce rapport soit disponible en français.

NOM _____

ADRESSE_____
rue App.

_____
ville province Code postal

No de téléphone ( ) _____

1.0 Background

Preserved wood foundations (PWFs) have been used for many years throughout Canada. Over the years, various wood preservatives have been used to enhance the durability of wood. Chromated Copper Arsenate (CCA) and Ammoniacal Copper Arsenate (ACA) have been widely used to pressure treat wood that is intended to be used in below grade building foundations and other exposed locations. Recently, concerns have been raised that the preservative chemicals may be released from the wood and potentially contaminate adjacent areas.

Fungi and other microbial contaminants can colonize building materials that may be exposed to moisture, such as foundation components. When PWF wall cavities are insulated and enclosed to form a wall system, the conditions within the system can be complex and conditions that support the growth of microbes may exist.

PWF wall systems represent potential sources of contamination of the indoor environment. Although air leakage from the wall cavities into a house may be small, over time the total volume of air transport could be significant. If the wall systems are opened for inspection or repair, contaminants contained within the wall system can be released in much larger amounts. In particular, arsenic and mold are potentially present within the enclosed stud cavities of PWFs.

Work practice guidelines exist for handling and cutting preservative-treated lumber and for general mold cleanup, however there is no specific information on conditions that may be encountered in existing pressure treated foundation wall cavities.

2.0 Introduction

This report summarizes the results from a field study of airborne arsenic and fungi concentrations in the wall cavities of ten houses with pressure treated wood foundations (PWFs). The study examined ten different foundations of various ages and configurations and involved field tests for airborne fungi and airborne arsenic within the enclosed stud cavities of the foundation walls. In addition to the field monitoring study, an informal telephone survey was made to municipal building departments in Saskatchewan to solicit information on the prevalence of PWFs in Saskatchewan.

3.0 Investigation Protocol – Overview

Field-testing was conducted in ten houses. At each house, an initial overview assessment of the foundation was done to gather information regarding the history and condition of the foundation. The initial assessment was a non-invasive, visual inspection for signs of current or past moisture, as well as a brief interview with the occupant(s) of the home when possible. Based on the initial assessment at each house, sampling locations were selected for air testing.

In most cases, the sampling sites were chosen on each of the home's four main exterior walls. Some of the homes tested were duplexes (with a common center wall) and therefore, only three sampling sites were used, one on each of the exterior walls for that side of the duplex. At each of the sampling sites within a house, two air samples were taken from the lower portion of the wall cavity, approximately five centimeters above the top surface of the bottom plate. Since arsenic and mold may exist as or on fine particles that would settle in closed wall cavities, sampling in the lowest portion of the wall was expected to measure the area of highest concentration of these contaminants within the wall cavity.

Both of the sampling methods drew a measured volume of air through sampling media to collect the compound/substance of interest. At each location, a small hole was drilled through the interior wall cladding, through the polyethylene air/vapor barrier and into the center of the insulated wall cavity. A sample probe was inserted into the center of the cavity, and the air sample was collected.

3.1 Test Methodology for Airborne Arsenic Concentration

NIOSH method 7300, Elements by ICP[1] was used to measure the airborne concentrations of elemental arsenic and it's inorganic compounds. The method uses thirty-seven millimeter filter cassettes and calibrated sample pumps to collect the air samples. Since NIOSH suggests that a flow rate between one and four litres per minute be used to test for arsenic, the samples were taken at an accurately measured flow rate of approximately two litres per minute.

The Health Canada 05 Tolerable Concentration[2] for arsenic is 7.8μg/m^3. The Saskatchewan Labour Occupational Health and Safety Regulations[3] state that 0.01mg/m^3 of airborne arsenic is the acceptable limit for an 8-hour average contamination. These values are equivalent to airborne arsenic concentrations of 0.0078μg/L and 0.01μg/L respectively.

The arsenic samples were analyzed by the Saskatchewan Research Council Analytical Chemistry Laboratory. The minimum detection limit of arsenic by the laboratory is 0.05μg per sample. For the purpose of this study, 2.5 percent of 0.0078μg/L (0.0002μg/L) was chosen as a target minimum detectable concentration. This level would allow the detection of arsenic to well below the Health Canada suggested tolerable concentration. A sampling time of approximately two hours, at a sample flow rate of approximately two litres per minute was chosen to meet both the requirements of the Elements by ICP method and the target minimum detectable concentration for arsenic.

[1]National Institute for Occupational Safety and Health
[2]The "05" represents a "potency which induces a 5% increase in the incidence of, or deaths due to, tumours considered to be associated with exposure"(Health-Based Tolerable Daily Intakes/Concentration and Tumorigenic Doses/ Concentrations for Priority Substances, Health Canada).
[3]Saskatchewan Labour "The Occupational Health and Safety Regulations, 1996"

The calculations to determine the minimum sample volume (MSV) and minimum sample time (MST) to ensure that the target minimum detectable concentration is met are as follows:

Equation 1
MSV = (minimum detectable mass on filter) ÷ (target minimum detectable concentration)
MSV = (0.05 μg) ÷ (0.0002 μg/L)
MSV = 250 L

Equation 2
MST = MSV ÷ (Flow Rate)
MST = (250L) ÷ (2 L/min · 60 min/hour)
MST = (250L) ÷ (120 L/hour)
MST = 2.08 hours

Assuming a sample flow rate of approximately 2 L/min, a minimum sampling time of approximately two hours was required.

The sampling apparatus utilized a pump regulated by a rotameter, set at a flow rate of approximately two litres per minute, to draw the air through the sampling media. Before each test, the sampling apparatus air flow rate was verified with a digital flow calibrator.

3.2 Test Methodology for Airborne Fungi

The airborne fungi sampling methodology utilized an Air-O-Cell air sampler to collect total airborne fungi. This was done by drawing a specified volume of air from the cavity through the sampling media. In most cases, the Air-O-Cell samples were taken for two minutes using a high volume pump that passed fifteen liters of air per minute through the sampling media, resulting in a total air sample volume of thirty liters. In situations where a greater amount of debris was suspected to be in the wall cavity, the sampling was conducted for one minute at fifteen liters of air per minute in an attempt to avoid overloading the sampling media. A digital flow calibrator was used to verify the flow rate through the sampling system.

The fungi samples were analyzed at Paracel Laboratories Inc. For each sample, the analysis provided the total number of fungi present as well as a breakdown of the fungal types and their relative amounts. If the slides were too heavily loaded with fungi or debris, the concentrations of fungi could not be accurately determined, and often the types present were not identifiable.

3.3 Test Methodology for Wall Cavity Temperature and Relative Humidity

The wall cavity fungi sampling apparatus was also used to obtain measurements of the wall cavity temperature and relative humidity. After the air sample passed through the Air-O-Cell cassette and the rotameter, the sample pump drew the air into a container holding a digital meter which measured both the relative humidity and the temperature of the air. A wet-bulb psychrometer was used to conduct spot calibration checks on the digital meter. The plastic tubing and temperature/humidity container volume and surface area were minimized to reduce the effect of heat transfer on the temperature and relative humidity measurements.

The temperature and relative humidity of the cavity were measured to characterize the conditions within the wall cavity. These measurements could also be used as an indication of significant moisture in the wall cavity at the time of testing.

4.0 Results

4.1 General House Information

Physical Condition Descriptors

Exterior Condition:

Good - The physical appearance of the foundation wall (no major cracks or anomalies) and the surface water management (eavestroughs/downspouts and landscaping/site grading) appeared to be good .

Poor - The foundation wall showed visible signs of damage or deterioration and/or the surface water management was inadequate.

Interior Condition:

Good - The interior wall finish was intact, no unusual odors were present and there was no evidence of deterioration or wetting.

Poor - The interior wall finish was damaged, a musty or stale odor was present or there was visual/reported evidence of deterioration or wetting.

Table 1. General House Information

House I.D.	Age of Home (years)	Type of Home	Exterior Condition	Interior Condition	Comments/History
1	26	Single Story Duplex	Good	Good	Rain earlier on the day of testing. Basement window over test site A was left open.
2	18	Single Story Duplex	Good	Poor	Evidence of slight water damage in the furnace and water heater area. Damp/musty smell in basement.
3	18	Single Story Four-Plex	Good	Good	Slight chemical odor present.
4	22	Bungalow	Poor	Poor	Home unoccupied for a long period of time. Windows boarded over and utilities disconnected. Significant evidence of chronic wetting.
5	22	Bungalow	Poor	Poor	Home unoccupied for a long period of time. Windows boarded over and utilities disconnected. Significant evidence of chronic wetting.
6	22	Bungalow	Good	Good	Situated on a high point of land.
7	22	Bungalow	Good	Poor	Leaking plumbing has caused wetting on interior walls.
8	26	Single Story Duplex	Good	Good	None
9	26	Single Story Duplex	Good	Poor	Damp/musty smell in basement.
10	21	Bungalow	Good	Good	None

4.2 Airborne Arsenic, Temperature and Relative Humidity Test Data

Table 2. Airborne Arsenic Concentrations, Temperature and Relative Humidity in Wall Cavities

House I.D.	Location	Airborne Arsenic Concentration within cavity (µg/L)	Cavity Temperature (°C)	Cavity Relative Humidity (%)
1	A	less than 0.0002	20.4	38
	B	less than 0.0002	20.3	38
	C	less than 0.0002	20.4	39
2	A	less than 0.0002	18.3	48
	B	0.00039	19.1	51
	C	less than 0.0002	19.2	47
3	A	less than 0.0002	20.8	41
	B	less than 0.0002	21.0	37
	C	less than 0.0002	20.2	37
	D	less than 0.0002	19.9	40
4	A	0.00039	16	51
	B	less than 0.0002	15.2	54
	C	less than 0.0002	14.6	53
5	A	less than 0.0002	13.1	66
	B	less than 0.0002	14.3	57
	C	less than 0.0002	14.6	56

6	A	less than 0.0002	20.5	56
	B	less than 0.0002	20.8	52
	C	less than 0.0002	21.4	47
	D	less than 0.0002	21.3	53
7	A	less than 0.0002	22.8	53
	B	less than 0.0002	23.1	50
	C	less than 0.0002	23.1	59
	D	less than 0.0002	23.2	47
8	A	less than 0.0002	22.7	43
	B	less than 0.0002	23	43
	C	less than 0.0002	23.6	36
9	A	less than 0.0002	20.7	44
	B	less than 0.0002	21.3	47
	C	less than 0.0002	21.6	48
10	A	less than 0.0002	16.5	40
	B	less than 0.0002	16.5	39
	C	less than 0.0002	16.8	38
	D	less than 0.0002	17.3	38

4.3 Total Airborne Fungi Concentrations in Wall Cavities

Table 3. Total Airborne Fungi Concentrations in Wall Cavities

House I.D.	Location	Air Sample Volume (L)	Concentration of Fungi by Type (counts/m^3)	Total Airborne Fungi concentration (counts/m^3)
1	A	30	N/A (overloaded slide)	N/A (overloaded slide)
	B	30	N/A (overloaded slide)	N/A (overloaded slide)
	C	30	none detected	none detected
2	A	30	Aspergillus/Penicillium	N/A (overloaded slide)
	B	30	none detected	none detected
	C	30	Ulocladium spores	N/A (overloaded slide)
3	A	30	N/A (overloaded slide)	N/A (overloaded slide)
	B	30	none detected	none detected
	C	30	pigmented mycelial fragments(221)	221
	D	30	N/A (overloaded slide)	N/A (overloaded slide)
4	A	15	pigmented mycelial fragments(3544), Amerospores(1107), Ascospores(443), Cladosporium spores(221) and Ulocladium spores(221)	5537
	B	15	Ascospores(17719), Amerospores(1329),Chaetomium species(664), pigmented mycelial fragments(664) and Chaetomium spores(221)	20598
	C	15	Amerospores(5094), pigmented mycelial fragments(443), Cladosporium spores(221) and hyaline mycelial fragments(221)	5980

5	A	15	Ascospores(664), Cladosporium spores(664), pigmented mycelial fragments(221) and Stachybotrys spores(221)	1772
	B	15	hyaline mycelial fragments, Chaetomium spores, pigmented mycelial fragments, Stachybotrys spores, Amerospores	N/A (overloaded slide)
	C	15	Aspergillus species, Chaetomium spores, hyaline mycelial fragments, pigmented mycelial fragments, Stachybotrys species, Ulocladium spores, Amerospores and Stachybotrys spores	N/A (overloaded slide)
6	A	30	Stachybotrys spores(1012), Ascospores(253), pigmented mycelial fragments(127), pollen(127) and unknown(127)	1645
	B	30	Aspergillus/Penicillium spores(253), Stachybotrys spores(253), Ascospores(127), Basidiospores(127), pigmented mycelial fragments(127) and Ulocladium spores(127)	1012
	C	30	Stachybotrys spores(1898), Aspergillus/Penicillium spores(127), Basidiospores(127) and Cladosporium spores(127)	2277
	D	30	Aspergillus/Penicillium spores(759), unknown(759), Stachybotrys spores(253), Basidiospores(127), pigmented mycelial fragments(127) and Smuts/Myxomycete/Periconia spores(127)	2151
7	A	15	Amerospores(1518), Basidiospores(253), Cladosporium spores(253) and Stachybotrys spores(253)	2277
	B	15	Amerospores(253) and unknown(253)	506
	C	15	Amerospores(506)	506
	D	15	Amerospores(1771), Basidiospores(506) and unknown(253)	2530

8	A	30	none detected	none detected
	B	30	Aspergillus/Penicillium spores(799), Amerospores(266),Cladosporium spores(266), Basidiospores(133)	1465
	C	30	Cladosporium spores(133), Drechslera spores(133)	266
9	A	30	Basidiospores(5593), Amerospores(2397), Aspergillus/Penicillium spores(533), Stachybotrys spores(266)	8788
	B	30	none detected	none detected
	C	30	Basidiospores(133)	133
10	A	30	none detected	none detected
	B	30	Ascospores(213)	213
	C	30	none detected	none detected
	D	30	none detected	none detected

** N/A (overloaded slide) – Background debris or molds were too numerous to count and could not be fully characterized.*

5.0 Discussion

5.1 General

Pressure treated wood foundation (PWF) homes have been built in Saskatchewan for over 25 years. In an informal telephone survey of municipal building departments, a number of issues were identified:

1) Most municipalities require these homes to meet the National Building Code and some require that a professional engineer design the foundation.

2) The distribution of PWF homes built throughout the province is dependant upon the area's geographic location. As an example, in the central northern region, an estimated 10-15% of homes built in 2003 have PWFs. In contrast, less than one percent of the homes built in the southern region in the past five years have PWFs.

3) A significant factor that influences the use of PWFs within the province is the local soil conditions. In soil with good drainage, PWFs are perceived as generally performing well. Since some of the northern regions are quite remote, PWFs can offer advantages in terms of construction methods and costs. In some areas in the southern regions of the province where the soil has a high clay content and does not drain well, PWFs have been reported to perform poorly.

Saskatchewan has no specific requirements as to the type of pressure treated wood used in building PWFs. The two types of preserved wood that have been commonly used in the province are Chromated Copper Arsenate (CCA) and Ammoniacal Copper Arsenate (ACA). According to the Canadian Institute of Treated Wood, both CCA and ACA provide long-term protection of the wood from fungi and insects.

5.2 Arsenic

All of the airborne arsenic levels within the wall cavities were non-detectable or at trace levels. The highest measured concentration was 0.00039 μg/L, which is five percent (one twentieth) of the Health Canada 05 Tolerable Concentration for arsenic. The measured levels do not indicate any significant release of arsenic from the wood into the air in the interior of the wall cavities.

It should be emphasized that the arsenic levels were determined by taking air samples from the lowest portion of the wall cavity. This methodology would only account for arsenic that was present in the air and airborne particles at this level, and would not identify arsenic that was attached to surfaces within the cavity.

5.3 Fungi

The fungi types and concentrations within building environments and outdoors can be highly variable. In Saskatchewan, the highest levels of fungi in the outdoor air are frequently identified in the late spring, summer and early fall, during periods of warm and dry weather.

There are no specific methods for interpreting Air-O-Cell sample results. In general, levels and types of fungi found outdoors could be expected indoors. As the "tightness" of the exterior of the building increases, more of the outdoor air fungi should be prevented from entering the indoor environment. Large indoor concentrations of fungi relative to typical outdoor levels or the presence of relatively large amounts of certain types of fungi that are not typical in outdoor air may indicate the presence of a building-related source.

As a component of other investigation projects, numerous outdoor air samples have been collected during the spring, summer and fall at locations throughout Saskatchewan. The results indicated that the total airborne fungi concentrations frequently exceeded 10,000 counts/m^3 and that the major fungi types present included Ascospores, Basidiospores, Alternaria spores, Cladosporium spores, Epicoccum spores and Ulocladium spores.

Occasionally, small numbers of Aspergillus/Penicillium spores, Amerospores and other fungi types or fungi fragments have been identified in outdoor air samples, but always as minor components of the total fungi present. Since PWF wall cavities could be open to the outdoors for long periods of time during construction and air infiltration would continue to provide some transport of outdoor airborne fungi into the walls, identifying wall cavity fungi characteristics similar to outdoor air could be expected.

Relatively low airborne levels of common outdoor air fungi types that are detected in the wall cavities may be indicative of relatively airtight, dry, and stable wall cavities. These types of results were observed in house locations 1 C, 2 B, 3 B/C, 8 A/C, 9 B/C, and 10 A/B/C/D.

The presence of Stachybotrys, relatively large numbers of Aspergillus/Penicillium spores or Amerospores or very high total airborne fungi concentrations (greater than about 10,000 to 20,000 counts per cubic meter) in the wall cavity air samples suggests that some fungal growth within the wall cavities may have occurred. The results for house locations 1 A/B, 2 A/C, 3A/D, 4 A/B/C, 5 A/B/C, 6 A/B/C/D, 7 A/B/C/D, 8 B, and 9 A indicate possible fungal growth.

Moisture is recognized as a dominant factor contributing to fungal growth in buildings. During the site monitoring, temperature and relative humidity levels in the wall cavities were measured. With the exception of the un-serviced houses (4 and 5), all of the wall cavities had similar temperatures and humidity levels. These conditions may not reflect the range of previous conditions that could have existed within the walls and did not appear to be related to the airborne fungi characteristics that were measured.

House 10 was a 21-year-old home that was built and continuously occupied by the owner. The interior of the basement appeared excellent, the house had good exterior grading and there was no history of water entry. The wall cavity airborne fungi sample results were consistent with the visual observations and identified negligible or very low levels of common outdoor fungi.

Houses 4 and 5 were approximately 22-year-old buildings, with both the houses and foundations in poor condition. The basement interiors were water damaged and some visible mold was observed in various places. The wall cavity airborne fungi sample results were also consistent with the visual observations and identified relatively high levels of fungi including Amerospores, Chaetomium spores, Stachybotrys spores and Aspergillus spores which are associated with water damaged building materials.

Houses 1, 3, 6 and 8 appeared to be in relatively good condition, without any specific features that would indicate water damage or other problems within the wall cavities. The wall cavity temperatures and relative humidity levels were similar to other houses in the study. The wall cavity airborne fungi results for these houses were not consistent with the visual observations, since a variety of fungi characteristics were identified that would not be expected unless fungal sources were present.

Houses 2, 7 and 9 had some interior conditions that were rated as poor. These houses also had wall cavity airborne fungi characteristics that indicated the presence of fungal contaminant sources.

Overall, the visual condition of the foundations did not appear to be a reliable indicator of the potential for fungal contamination within the wall cavities.

6.0 Summary

The results from the study indicated that airborne arsenic levels in the exterior wall cavities of PWFs were consistently very low. Wall cavity airborne fungi characteristics were highly variable, but frequently indicated the presence of fungal contaminant sources. The visual condition of the exterior and interior surfaces of the foundation walls was not a reliable indicator of the airborne fungi characteristics within the wall cavity.

Visit our home page at www.cmhc.ca