

Biodet Services Ltd

Consulting Industrial Microbiologists

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NON-CULTURABLE AIR SAMPLING REPORT

DATE OF REPORT	27 July 2021	CLIENT:	Healthy Home Inspections Ltd
BUILDING:	Hardwick Smith Lounge		68C Queen Street West
DATE SAMPLES TAKEN:	19 July 2021		LEVIN 5510
DATE SAMPLES RECEIVED:	21 July 2021		
DATE SAMPLES ANALYSED:	27 July 2021		
BIODET REF NO:	21/43967	Attn:	Noel Richards

Method: ASTM D 7391 -20 Categorisation and Quantification of Airborne Fungal Structures in an Inertial Impaction Sample by Optical Microscopy

Air Volume sampled: 150 litres of air. (Sampled using a Buck Bioslide sampler)

The final result is expressed as fungal structures per meter cubed (/m³). Limit of detection is 7 fungal structures per m³ (0 = <7)

Sample Number	Slide Number	Location	<i>Cladosporium</i>	<i>Penicillium/Aspergillus</i> type	<i>Stachybotrys</i>	<i>Chaetomium</i>	<i>Alternaria/Ulocladium</i>	<i>Pithomyces</i>	<i>Drechslera/Bipolaris</i>	<i>Epicoecum</i>	<i>Curvularia</i>	<i>Fusarium</i>	Basidiomycete	Hyphal Fragments	Other Spore Types	Fungal Structures TOTAL /m ³	Spore Clusters	Pollen
43967/1	02454846	1. Outside	13	40	0	0	0	0	0	0	0	40	60	7	2353	2513	13	0
43967/2	02453008	2. Toilet, near entrance	27	307	0	0	7	0	0	0	0	7	20	0	14733	15101	33	7
43967/3	02455030	3. Centre of lounge	140	487	0	0	0	7	0	0	0	7	27	13	2087	2768	60	0
43967/4	02454296	4. Kitchen	140	7233	7	0	0	0	0	0	0	13	13	7	5633	13046	413	0
43967/5	02454478	5. Small lounge, on right	227	4480	7	7	7	0	0	0	7	0	27	373	12367	17502	273	0

Results highlighted in red are considered to be unusual amplification.

Results highlighted in brown suggest there may be localised slight amplification.

Particle Analysis - Extraneous Material

Sample No.	Slide Number	Location	Bacterial clusters	Siliceous	Fibres	Skin	Rust	Amorphous
43967/1	02454846	1. Outside	0	+	+	+	+	++
43967/2	02453008	2. Toilet, near entrance	+	+	++	++	+	++
43967/3	02455030	3. Centre of lounge	0	+	+	++	+	++
43967/4	02454296	4. Kitchen	0	+	++	++	+	++
43967/5	02454478	5. Small lounge, on right	++++	+	+++	++	+	+++

Particle Level Key

Abundant	+++++
High	++++
Moderate	+++
Light	++
Sporadic	+
Not present	0

CONCLUSIONS:

Stachybotrys was detected in very low levels in the Kitchen and Small lounge, on right samples. *Chaetomium* was also detected in a very low level in the 'Small lounge, on right' sample. The presence of these fungi is always indicative of sustained raised relative humidity (99%) resulting in fibre saturation of certain building materials, which would likely occur over a period of weeks to months. Possible scenarios that could give rise to this condition include on-going leaks or a major wetting event. These fungi are considered to be toxigenic and are undesirable in indoor air.

Penicillium/Aspergillus spore levels were also elevated in both Kitchen and Small lounge, on right samples. The types noted indoors differed from those noted in the outdoor sample, suggesting the presence of indoor fungal reservoirs. These fungi grow indoors in response to moisture 'dewing' out onto surfaces that can often be due to moisture ingress issues or may be an accumulation of condensation in an area lacking good ventilation that has then resulted in localised superficial fungal growth. These spore types may be allergenic to sensitive people, and some of the species may cause infections in immunocompromised individuals.

The *Penicillium/Aspergillus* spore levels in the other two areas sampled were slightly raised with the fungal spore types similar to the one observed in the Kitchen and Small Lounge, on right samples. The results suggest either localised fungal reservoirs at a smaller scale in the Toilet, near entrance and Centre of Lounge, or the air in these areas were influenced by the fungi from the Kitchen and Small lounge, on right. The levels in these areas would be unlikely to result in health issues.

The 'Other Spore Types' levels were unusually elevated especially in the Toilet, near entrance and Small lounge, on right. An unidentified fungal spore that predominated the Toilet, near entrance in the 'Other Spore Types' category was only noted sporadically in the outdoor sample, again suggesting the presence of indoor fungal reservoirs. The Small lounge, on right exhibited a moderate level of *Wallemia*, with this fungus observed in lower levels in the Kitchen and the Centre of lounge samples, suggesting that the Small lounge, on right may be the primary reservoir. *Wallemia* is considered a xerophilic fungus (able to grow in very low-level moisture environments) but is often found associated with very damp building materials. This fungus is thought to be allergenic, and has also been implicated in a condition known as 'Farmers Lung' (a hypersensitivity pneumonitis). A very low level of *Scopulariopsis* was also observed in the Small lounge, on right sample. *Scopulariopsis* species have been known to be isolated from water damaged building materials and can be deterring, particularly in carpets.

Elevated spore cluster and hyphal fragment levels can be indicative of active fungal growth.

All other spore levels and types indoors were either lower than or comparable to the outdoor sample, and were generally within the range for a non-air-conditioned indoor environment.

The presence of abundant bacterial clusters in the Small lounge, on right is a classic symptom of water-damaged carpet. Although the types of bacteria cannot be determined from this type of sampling, there is likely to be a high probability of gram-negative bacteria to be present. These bacteria may cause respiratory symptoms involving allergic type reactions. Gram-negative bacteria are so small they may be capable of deep penetration into the lung upon aerosolisation. They possess an endotoxin, which is emerging as an important factor in respiratory syndromes. The endotoxin is part of the gram-negative cell wall. Although the bacteria may be rendered non-viable (dead), the endotoxin retains its toxicity, even through extremely high temperatures. Their impact on individuals is dose related (ie. The higher the level the more likely the symptoms will occur). Symptoms typically involve elevated temperatures, followed by malaise and respiratory distress. Occasionally skin reactions may occur. (From Indoor Air Quality, Hess-Kosa.)

Extraneous particulate levels ranged from sporadic to moderate, which is not unusual in a non-air-conditioned indoor area. Where moderate particulate levels were noted, this may be an indication that there is less ventilation or air movement.

It is recommended that the indoor areas exhibiting elevated results not be used until remediation can occur. Anybody entering the rooms should wear appropriate personal protective equipment. Any hard-surfaced items being removed from the room should be wiped down with warm soapy water and dried thoroughly. Soft furnishings may be HEPA-filter vacuumed and textiles laundered, but this does not guarantee the removal of potential toxigenic sub-micron fungal elements. The installation of portable air purifiers may help reduce the airborne fungal spore levels if these areas are to be continued to be used prior to remediation occurring.

If any of the occupants are concerned about health issues, it is recommended that they consult with a qualified medical professional over any potential health risks associated with the findings in this report.

Yours faithfully



Neethu Arun

M.Sc.

The samples were tested as received.

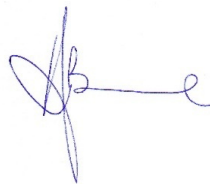
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**AIHA PROFICIENCY ANALYTICAL
TESTING PROGRAMS**

Fungal Direct Examination Test

Biodet Services Ltd status: **Proficient**



Adrienne Burnie

B.Sc., NZCMT

Biodet Services Ltd
Consulting Industrial Microbiologists

MEMBER OF NEW ZEALAND ASSOCIATION OF CONSULTING LABORATORIES

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BIODET INDOOR SPORE TRAP DATABASE

(Average counts taken from indoor sources throughout New Zealand between 2017 and 2019)

	<i>Cladosporium</i>	<i>Penicillium/Aspergillus</i> type	<i>Stachybotrys</i>	<i>Chaetomium</i>	<i>Alternaria/Ulocladium</i>	<i>Pithomyces</i> *	<i>Drechslera/Bipolaris</i>	<i>Epicoecum</i>	<i>Curvularia</i>	<i>Fusarium</i>	Basidiomycete	Hyphal Fragments	Other Spore Types	Fungal Structures TOTAL/m ³	Spore Clusters	Pollen Grains
Non Air-conditioned environments																
With elevated fungal spore levels indicating moisture issues	1404	8643	208	48	30	0	1	10	3	21	302	125	6916	17711	644	23
Without elevated fungal spore levels	347	71	0	0	3	0	0	5	1	15	111	26	2622	3201	29	16

BIODET OUTDOOR SPORE TRAP DATABASE

(Average counts taken from outdoor sources throughout New Zealand between 2017 and 2019)

Spring (Taken 1 September to 30 November)	1071	58	0	0	2	0	0	5	0	16	172	22	3603	4949	85	228
Summer (Taken 1 December to 28/29 February)	3535	194	0	0	37	0	15	51	22	44	861	35	12543	17337	381	46
Autumn (Taken 1 March to 31 May)	811	104	0	0	23	0	1	15	2	41	886	25	9986	11894	105	35
Winter (Taken 1 June to 31 August)	155	76	0	0	1	0	0	1	0	53	264	13	6998	7561	49	72

* This category was separated out from *Alternaria/Ulocladium* in 2020

INTERPRETATION OF RESULTS

Unless stated all sample traces are 100% examined at 1000x magnification which is higher than recommended in the methodology. This is to ensure the minute differences between fungal spores are more easily identified allowing them to be accurately categorised.

Due to the numerous variations observed with sporetrapping it is important that a microbiologist with experience interpret the results.

Biodet staff take part in the AIHA Proficiency Analytical Testing Program for Fungal Direct Examination. This is an international interlaboratory comparison program comprising of laboratories across the world. Results may be supplied upon request.

Biodet staff interpret the results based on the information given by the client, previous results (if known) and our experience gained from analysing spore trap samples and assisting with air quality investigations since 2003.

Many fungal types found in outdoor air can also be the types that grow indoors in response to moisture. This is why it is recommended to take an outdoor sample with each job to show what current 'normal' levels and types are for each geographical location. This allows Biodet staff to compare the indoor fungal species and levels with the outdoor fungal species and levels, as well as with our database, to determine whether there are any indications of moisture issues.

In areas where there are no moisture issues it is typical to find that fungal spore counts taken from non-air-conditioned indoor areas are similar to or lower than the outdoor air, where as fungal spore counts taken from well maintained HVAC air-conditioned areas are typically significantly lower than the outdoor air.

The presence of some fungal spores in an indoor environment even in low levels, such as *Stachybotrys* and *Chaetomium*, can be an indication that there are moisture issues. For other fungal types such as *Cladosporium* or Basidiomycete spores a 10-fold increase may indicate a site of fungal amplification. These subtle variations show why it is important that a microbiologist with experience interprets the results.

The 'Other Spore Types' category are comprised of microscopically unidentifiable fungal spores, Smuts/Myxomycete/Periconia and a range of ascospores (fungal spores produced in a sac or body in response to adverse environmental conditions) and some basidiospore types. The majority of these spores are not associated with specific health issues, but exist in the natural environment, especially where there is dense vegetation or soil. Levels will vary due to seasonal variation and proximity to vegetation etc. Occasionally a spore type not represented by any of the other categories is noted in this category, and if the level of this spore type was significantly different to the outdoor air or other indoor samples, it would be specifically commented on.