A L A R A
Environmental Health & Safety Ltd.

Metro Home Inspections
7626 Arvin Court
Burnaby, BC V5A 4M9

October 4, 2010

ATTENTION: Mr. Mark Fagrie

RE: Indoor Air Quality Investigation at Little Mountain Housing, 159 Grouse Walk, Vancouver, BC

Dear Mr. Fagrie

Executive Summary

At the request of Mr. Fagrie, ALARA Environmental Health & Safety sampled for mould and petroleum hydrocarbons within unit 159 in the last remaining townhouse building in the old Little Mountain Housing complex located on Main Street between 33rd and 37th Avenues in Vancouver BC.

The main focus of the indoor air quality (IAQ) investigation was the possibility of airborne pathogens causing adverse health effects. The sample collection focused on the entire townhouse 159 Grouse Walk and the outside.

The purpose of the investigation was to ensure no health hazards would be encountered during the occupation of this suite by tenants. Two bio-aerosol samples, two mould swabs and 4 ATP samples, and a VOC sample was collected. A thermal imaging camera was also utilized.

Sample results indicate that airborne mould contamination does not exist. Swab sampling results indicate that no elevated concentration of mould spores exist in the unit. VOC sampling indicates that levels of hydrocarbons (C_6-C_{13} and C_{10}-C_{12}) exists within the basement in the range commonly associated with fuel oil (C_{10}-C_{19} and C_{19}-C_{32}). Although the sampled range is only a part of the fuel oil range it acts as an indicator that fuel oil vapour has entered the building. Adverse human health effects to chronic exposure to hydrocarbons may occur in concentrations above the threshold limit value. At this time no correlation between the sampled fractions and ACGIH threshold limit value can be made without further sampling for the complete carbon range associated with fuel oil (diesel). The thermal scan did not identify any water leaks.

Introduction

The areas of concern within the building were inspected for unusual odours and moisture, and sampled for the potential build-up of contaminants: Moulds and VOC. The building is the last of several that were to be spared from demolition. The housing complex had several identical townhouse buildings located on it. During the demolition and excavation process of the other buildings, hydrocarbon contamination (EPH) was identified throughout the site from several

underground fuel tanks (USTs) used for heating fuel. ALARA entered unit 159 Grouse Walk to assist in determining if the suite was safe for occupancy.

During the site visit, ALARA observed a two story townhouse with full height unfinished basement. The upper floors were clean and unstained, while the basement walls had some signs of mould.

Method

Air sampling was conducted by placing an uncovered agar dish into a bio aerosol impaction sampler. Microscopic spores were drawn into the sampler and impacted onto the agar dish. The agar dish was prepared with specific nutrients conducive to moulds growth. Approximately 140 litres of air were sampled at a flow rate of 28.4 L/min for 5 minutes. Units of colony forming units per cubic meter of air (CFU/m^3) were assigned to the test result.

Swab mould samples were described as a long rod with a cotton wad on the end. The swab was then contacted with the area that was to be sampled and returned into a vial having enough nutrients to sustain the life of mould until it was delivered to the microbiological laboratory. This sampling method captures moulds, which was then incubated to promote the growth of the living microscopic organisms into countable colony forming units (CFU). The swab was contacted to the surface in a 10 cm x 10 cm area while being slowly rotated. Results were expressed as $spores/cm^2$.

Swab ATP samples were analysed for ATP concentrations. These swabs were described as a long rod with a cotton wad on the end. ATP were organic energy transfer molecules that were expected to be synonymous to mould or mould fragments. ATP does not discriminate between viable or non-viable moulds. The swab was then contacted with the area to be sampled and returned into a vial having a phosphoressent chemical that emits light. This light was measured and expressed as relative light units (RLU). This sampling method analyses all organic matter. The locations chosen were in areas not usually associated with organic matter, and therefore, the results were assumed to be mould.

One VOC air sample was collected using a Thermal Desorption (TD) tube. The tube was connected to an air pump having a flow rate of 0.202L/min for approximately 4 hours. The results were broken into various components. Volatile hydrocarbon range C_6-C_{13} and C_{10}-C_{12} were only considered as they are part of the volatile vapours from fuel oil.

A Fluke thermal camera was used to scan the entire townhouse for cold spots that may be caused by water ingress. The upper and main floors were scanned for temperature differences.

Results

On September 9, 2010 two bio aerosol air, two mould swabs, four ATP swabs, and one VOC sample were collected. Sample results are as follows:

Table 1 - Sampling Results

Sample Number	***Sample Type***	***Location / Description***	***Mould CFU/m^3***
001	***Mould Air***	***Laundry Room***	***Cladosporium 56 Penicillium 20 Non Sporulating 8 Mucor 4***
002	***Mould Air***	***Basement***	***Cladosporium 130 Penicillium 46 Aspergillus 10 Mucor 5 Non Sporulating 8***
003	***Mould Air***	***Outside***	***Cladosporium 170 Penicillium 23 Aspergillus 6 Mucor 5 Non Sporulating 10***
Sample Number	***Sample Type***	***Location / Description***	***Mould Spores/cm^2***
004	***Mould Swab***	***UP Washroom***	***<***
005	***Mould Swab***	***Basement***	***Cladosporium 1099/cm2 Penicillium 572/cm2***
Sample Number	***Sample Type***	***Location / Description***	***ATP RLU /100 cm^2***
006	***ATP Swab***	***Entrance wall***	***8 RLU***
007	***ATP Swab***	***Staircase wall***	***21 RLU***
008	***ATP Swab***	***Living room wall***	***8 RLU***
009	***ATP Swab***	***SW Bedroom Closet wall***	***16 RLU***
Sample Number	***Sample Type***	***Location / Description***	***VPH and Aliphatic C6-C13 ug/m3***
010	***VOC C_6-C_{13} VOC C_{10}-C_{12}***	***Basement***	***110ug/m^3 35 ug/m^3***

Note: <1 = less than one
CFU/m3= colony forming units per metre cubed

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Discussion

ALARA arrived on site to assist in determining if the building could safely be reoccupied. A visual assessment was conducted to determine if mould staining existed on the any walls or within the attic space. No visual signs of mould were identified except within the basement.

Air samples were collected from within the laundry room and from the basement. Air samples were collected to measure an occupant's exposure to airborne mould spores. Interior samples were compared to outdoor samples for mould species and concentrations. Mould species and concentrations were similar inside the house to those found outside the house. During the inspection, ALARA was informed that due to the methods used at the time of construction, the townhouse was expected not to be very air tight and allowing rapid air exchanges with the outside. Rapid air exchanges can dilute interior mould concentrations and potentially misrepresent amplification sites.

Mould swab samples were collected in locations that seemed to have staining commonly associated with mould. One sample was collected from a stain located in the upstairs washroom near the electrical outlet, and the other from the white crystallization in the basement. The sample in the upstairs washroom indicated that the stain was not mould related, while the stain in the basement indicated that the concrete wall likely became wet throughout the season and had high concentrations of Penicillium and Cladosporium moulds. These moulds are common outdoor moulds that are often found indoors. High concentrations of these moulds, if found in the airstream, can cause health effects in humans.

ATP swab samples were collected in 4 locations to further identify if any potential mould was growing on the walls by analyzing for the ATP protein. Samples were collected from walls at the entrance, staircase, living room, and southwest bedroom closet. None of the ATP swab samples had RLU concentrations considered excessive.

VPH and aliphatic VOC fractions were sampled. Air sampling was conducted within the basement of the townhouse. Petroleum hydrocarbon (EPH) air sampling was conducted since the site was known to contain EPH contamination from the various fuel oil (diesel) tanks (USTs) that were abandoned on the site. The USTs were a common source of heating fuel prior to about 1950 when natural gas was introduced. USTs were commonly left in the ground and often did not have the remaining fuel pumped out. In time, the tanks rusted and the fuel oil seeped out. The purpose of this test was to determine if the possibility exists for fuel oil contamination to exist around and below the building. The sample was collected from within the basement when the attic hatch was left open to allow for a "stack effect" to draw soil vapor into the home. The sample was located in an area were soil gas could migrate into the home. Sample results indicated that a significant concentration of VPH and aliphatic was detected in the basement (above detection limits). Fuel oil has a known carbon fraction of C_{10}-C_{19} and C_{19}-C_{32}. The test was conducted since VPH and aliphatic chains have a carbon fraction of C_6-C_{13} and C_{10}-C_{12} respectively. This fraction, although not the complete fuel oil fraction, was chosen as the indicator for fuel oil vapor. The C_6-C_{13} and C_{10}-C_{12} fraction is not directly comparable to the ACGIH threshold limit value for diesel fuel since only part of the carbon chain was sampled. Additional testing must be conducted to determine if the time weighted average for diesel was exceeded.

A thermal camera was used to scan the interior of the home to identify cold spots that could be associated with water ingress. No typical water ingress cold spots were identified.

Conclusion & Recommendations

The investigation conducted by ALARA indicated that minimal mould concentrations were identified within the house. No amplification sites were identified during the walk through or by the sampling results. ALARA was informed that the typical construction technique of that era was not very air tight and allowed for rapid air exchanges with the outside air, possibly diluting any mould amplification sites.

VPH and aliphatic VOC concentrations within the basement indicated that petroleum hydrocarbons have migrated into the home. The C_6-C_{13} and C_{10}-C_{12} fraction was identified in elevated concentrations (above detection limits). Heavier carbon fractions of EPH are also expected to have migrated into the home. Additional testing is recommended to determine if the ACGIH threshold limit values time weighted average for diesel has been exceeded. Adverse human health effects to chronic exposure to petroleum hydrocarbons may occur in concentrations above the TLV.

Thermal imaging was conducted using a Fluke thermal imaging camera. No significant sources of water ingress were identified into the building.

Statement of Limitations

This report is based on conditions that were present during the time samples were collected. Additional information was obtained in interviews from sources that ALARA Environmental Health & Safety Ltd. believes to be accurate, yet is not responsible for.

Sincerely,

ALARA Environmental Health & Safety Ltd.

Via Email; Steven Seewald

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