Industrial Hygiene Resources
8312 W Northview St. #100 Boise, ID 83704
Phone: (208) 323-8287 Fax: (208)323-0783
www.IndustrialHygieneResources.com

Protecting Your Workers

21 December 2020

Jesse Coiro
Director of Growth & Strategic Initiatives
ERLab
388 Newburyport Turnpike
Rowley, MA 01969

Re: Assessment of an ERLab Halo HEPA Filtration Unit
Avamere Facility, Boise ID
IHR 6600

IHR conducted an assessment of a ceiling mounted Halo HEPA filtration unit on 18-19 November 2020 at the Avamere Transition Care & Rehabilitation Facility in Boise, Idaho. Prior studies have assessed the Halo unit in a laboratory setting[1,2]. This report documents an *in situ* assessment which was conducted in rooms with residents who tested positive for the SARS-CoV-2 virus within an occupied rehabilitation facility in Boise.

Executive Summary

In-room air purification remains an important option to reduce the airborne viral load within long-term health care facilities– for resident rooms, resident and staff common areas, and staff/administrative offices. This finding is not specific to the SARS-CoV-2 virus but is applicable to any disease or situation that can cause exposure or secondary infections through airborne transmission.

Background

During the 2020 covid-19 pandemic, long-term health care (LTHC) facilities in Idaho experienced a significant[3] rise in SARS-CoV-2 virus among residents and staff. In August 2020, ERLab installed a Halo HEPA filtration unit (photo 4) within a resident room at the Avamere facility in a cooperative effort with the facility to assess the *in situ* efficacy of the unit to reduce airborne contaminants. The unit was installed and operational in late August within room 120. After installation, room 120 remained unoccupied until just prior to this assessment in November. On 16 November, a resident was transferred to room 120 who tested positive for the SARS-CoV-2 virus and required isolation. Room 120 with

[1] Aerosol Research and Engineering Laboratories: S. MeLeod & J. Trolinger, *Efficacy of the ER Lab Hal P d3Device against Aerosolized MS2 Virus*, ARE Labs Inc, 2020
[2] 3Flow, *ERLab Halo-O Air Purifier Filtration Test Report*, September 2020
[3] In one 2020 Idaho study, LTHC staff attack rates ranged from 16.5-44.7% and resident attack rates ranged from 24.6-85.9%

the Halo air purification unit was compared with Room 118 which is on the same hallway and HVAC system as room 120. Room 118 also has a covid positive resident in isolation. Room 118 did not have an air purification unit.

HVAC Inspection

Prior to the testing, IHR inspected the Avamere facility to assess the ventilation system and document basic airflow conditions. The Avamere facility was built in the 1970s and uses roof mounted 5 and 10-ton HVAC units (photo 1) for mechanical ventilation. There was no history or documentation available regarding facility air balance data or determination of air changes per hour in the patient rooms. The facility currently uses MERV[4] 13 filters in the HVAC units which are reportedly changed on a quarterly basis. The louvers on the HVAC unit feeding rooms 120 and 118 were closed, allowing only a minimal amount of outside air into the ventilation system. The HVAC units are set to occupancy demand and hence do not continually supply air to the rooms.

Supply air is ducted to patient rooms (photo 7) and return air (photos 2,3,8) is received in ducted returns which have insulation on the inside of the ductwork. Each room has a supply diffuser near the center of the room and a return air vent near the doorway – see figures 1 and 2. Bathrooms in the rooms have ventilation fans which are only activated when used. Toilets in the bathroom do not have lids. The window in the rooms do not open. The hallway door is typically left open during the day[5] which allows the room air to comingle with the hallway air. When the hallway door is closed, the room is at a slightly positive pressure with respect to the hallway when supply air is provided into the room.

Methodology

The basic test setup is shown in Table 1. A schematic of the two rooms is shown in figures 1 and 2. The rooms had slightly different configurations. Duplicate samples for airborne particulate typing and analysis were collected on air-o-cell cassettes at 15 Lpm for 5 minutes. Samples were analyzed by EAA laboratories in Bay City, Michigan.

Air particulate sampling was conducted for 1.25 days using a TSI DustTrak DRX model 8533 (photo 6). Samples were collected and logged every minute for the following size ranges: 1.0 micron, 2.5 micron, 4 micron, and 10 micron.

Surface sampling for SARS-CoV-2 genetic markers was performed utilizing a kit containing a sterile swab and a vial with 1 mL solution of Puritan PurSafe DNA/RNA preservative. Kits were obtained from the testing laboratory as manufactured by Puritan Medical Products in Gullford Maine. While collecting the sample, swabs were rotated for maximum loading and covered a surface area of approximately 1-2 inch^2. A separate kit was used for each swab sample. Swab tips were placed into the DNA/RNA 1 mL preservative and sent to Prestige EnviroMicrobiology Laboratory in Voorhees, New Jersey for polymerase chain reaction (PCR) analysis.

[4] MERV ratings are *minimum efficiency reporting value* ratings for filters as established by ASHRAE, the American Society of Heating Refrigeration and Air-Conditioning Engineers

[5] This is for fall risk considerations, socialization, and resident mental health

Figure 1 - Room 118 Schematic

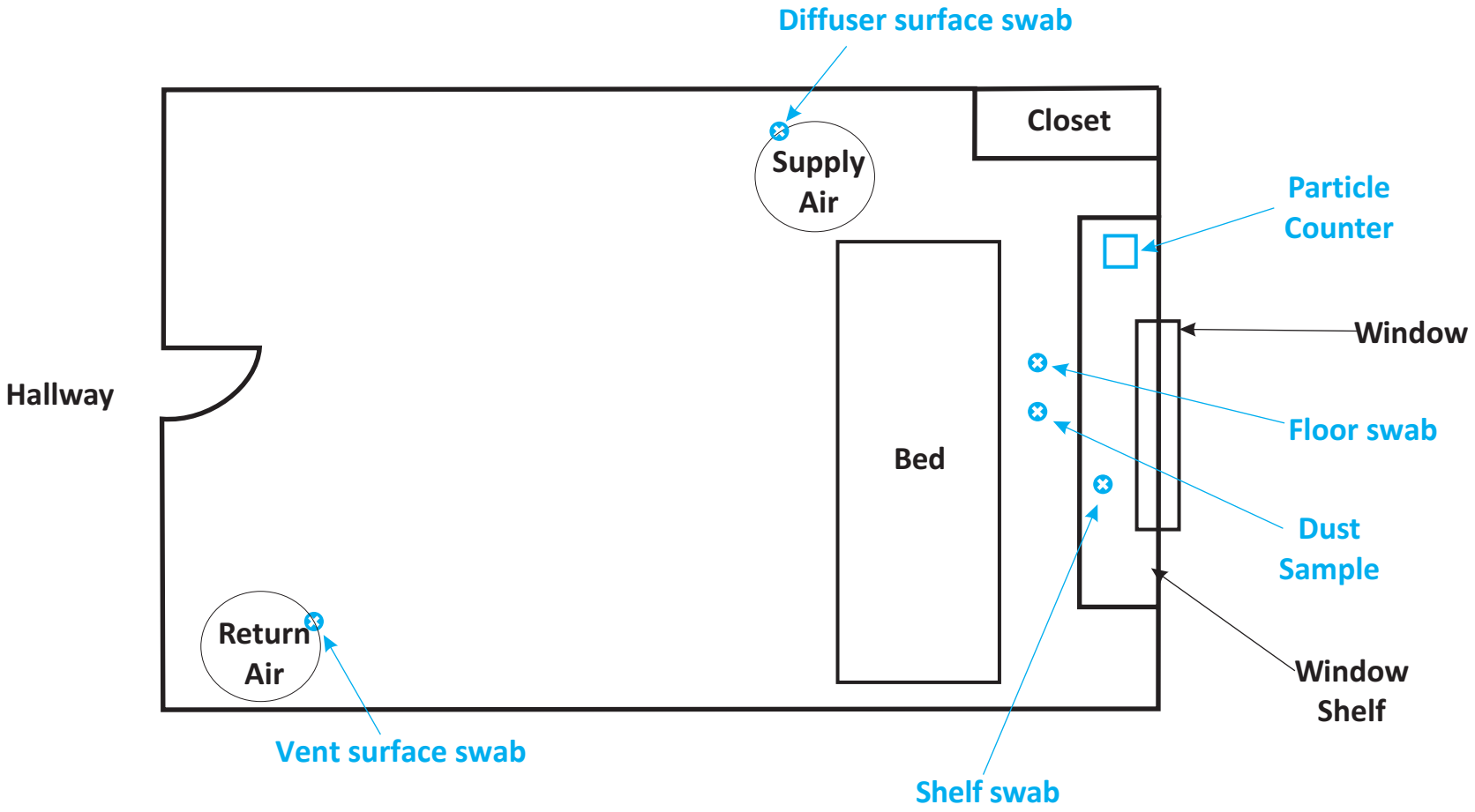


Figure 2 - Room 120 Schematic

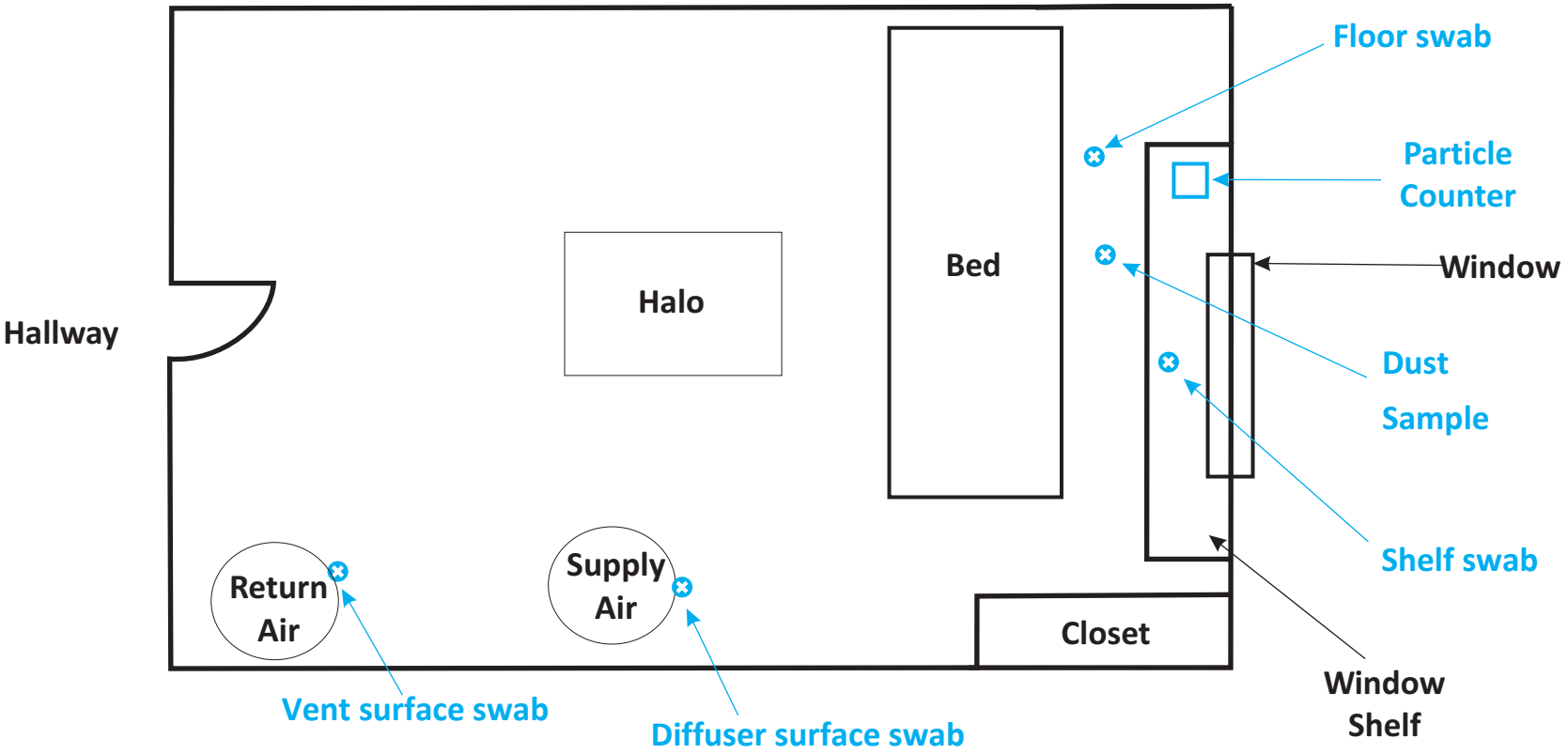


Table I. Conditions and Sampling

Room 118	Room 120- With Halo Unit
Confirmed covid positive resident near end of isolation, unknown to what extent resident was shedding the virus. Hallway door was open. Prior to this resident, the room was unoccupied for ~5+ weeks.	Confirmed covid positive resident; data show resident was actively shedding virus. Resident was midcourse in isolation. Hallway door was open. Prior to this resident, the room was unoccupied for ~5+ weeks.
No Halo HEPA filter unit or other air cleaning unit was installed in room	A Halo HEPA unit was installed on the ceiling between the resident bed and the return air register. Halo unit was operational for 5+ weeks (at ~130cfm) before the arrival of the covid positive resident.
Air sampling for dust analysis - Duplicates - Same locations as room 120	Air sampling for dust analysis - Duplicates - Same locations as room 118
Particulate sample logged for 30 hours, same location as in room 120	Particulate sample logged for 30 hours, same location as in room 118
Surface samples for covid were analyzed by PCR - 4 sample locations; same as in room 120	Surface samples for covid were analyzed by PCR - 4 sample locations, same as in room 11

Droplet vs Airborne Disease Transmission

In October 2020[6], NIOSH and the CDC acknowledged that while the primary route of exposure to SARS-CoV-2 was from infected droplets, airborne transmission was also a route of exposure. Per NIOSH, in terms of spreading the SARS-CoV-2 virus and causing secondary infections: droplet aerosol > airborne transmission >> surface contact. Hence the presence of both aerosol droplets and airborne particulates are of concern as routes of exposure and potential transmission of SARS-CoV-2 in LTHC and other facilities.

Larger respiratory droplets and aerosols are normally defined as being generated via a cough or sneeze (talk, sing, etc.) and from certain medical procedures like intubation and bronchoscopy. Broadly called aerosols, these droplets can be visible and typically fall out of air onto surfaces rapidly, i.e., ballistically, within seconds to minutes while close to the source. Droplets typically fall to surfaces within approximately 2 meters.

Airborne transmission refers to small particulates which are capable of transmitting an infectious disease through the air. These particulates are usually less than 5 microns in size and are not visible. Airborne particulates can remain suspended in the air for minutes to hours and can travel significant distances from the source depending on the ambient airflow conditions. Secondary infections of measles and tuberculosis[7], for example, can occur minutes to hours after an infected source patient has left the room depending on the viral or bacterial load in the air. At this time, it is not known what viral loading in air is required to cause a secondary infection of SARS-CoV-2. Reducing the overall viral load in air, however, is considered a prudent practice.

[6] CDC Scientific Brief: SARS-CoV-2 and Potential airborne transmission, updated 10/5/2020

[7] Infections from viral measles and bacteriological tuberculosis are documented to occur via the airborne transmission route

Results and Discussion

Table II presents the average air particulate analysis results for the two rooms. Although the data are limited by the small sample size[8] and several unknown variables[9], the general trend shows a reduction in skin cells (photo 5), synthetic fibers, opaque particulates, and particulates identified as minerals and clays. The pollen and spore counts are interpretated as the same in both rooms. The typical source of the contamination is also listed in Table II. Skin cells, and synthetic fibers from clothing are easily recognized as being generated within the room whereas pollen counts and fungal (mold) spore counts generally originate from outside the building.

Particulate skin cells, seen as red circled particulates in photo 5, may be important as possible carriers of various bacterial and viral pathogens, e.g., methicillin-resistant staphylococcus aureus (MRSA) and potentially the SARS-CoV-2 virus.

Table II. Average Particulate Analysis by Type

Particle Type	Room 118 average counts	Room 120 average counts with HALO unit	Contaminant Source: indoor v outdoor
Spore total count	213	258	Outside air
Pollen	13	13	Outside air
Mineral/clay	2,265	1,875	Outside air/dust
Skin cells	1,967	1,785	Inside room
Synthetic fibers	183	137	Inside room
Opaque particles	3,385	1,850	Inside room

Particle size analysis results are shown in Table III. The average results in micrograms per cubic meter (ug/m^3) for each particulate size were obtained by sampling and data logging each minute for 30 hours. The same unknowns, as noted before, apply to these data- see footnote 7. The trend, however, shows a reduction of particle sizes for each of the categories. Notably there is a reduction in the average particle sizes in the 1-4 micron particles which encompasses the respirable range of particles in the air.

Table III. Average Particulate Concentration by Size for 30 hours

Particle Size	Room 118 Average concentration in ug/m^3	Room 120 with Halo unit; Average concentration in ug/m^3
PM 1	5.0	0.0
PM 2.5	5.0	0.0
PM 4 (respirable)	5.0	0.0
PM 10	6.0	1.0
Total	6.0	4.0

Note: PM 1 results, for example, mean the average airborne concentration of particles 1 micron or less in size

[8] Data show the average of duplicate samples. More data would be required to establish statistical significance between the two rooms.

[9] Such as number of visitors to the room, cleaning schedule, activity in the room before the sampling, hallway activity prior to sampling, etc.

Of the different test methods, the gold standard for covid-19 environmental surface and air analysis is the reverse transcriptase polymerase chain reaction (RT-PCR) method. It is important to emphasize that the detection of SARS-CoV-2 RNA does not directly translate into the amount of viable or infectious SARS-CoV-2 virus, although this is sometimes assumed. Results were positive for covid-19 if both the N1 and N2 protein markers cross the threshold within the 40 cycles required for the fluorescent signal in RT-PCR to exceed the background threshold level. The number of copies represent the quantification of RNA and can be directly compared.

Table IV presents the results of the surface sampling and analysis by PCR for covid-19. Four swabs were collected in each room at the same locations. Three swabs tested positive for covid-19 from these eight samples. Recall that prior to this testing, the rooms did not have a covid-19 resident or any resident for over 10 weeks.

Table IV. Covid-19 Surface Sample Results by RT-PCR

Location in Room	N1, N2 proteins	Result	# RNA copies
118 supply diffuser	ND	ND	ND
118 return vent	positive	positive	3,500
118 floor by bed	ND	ND	ND
118 window shelf	ND	ND	ND
120 supply diffuser	ND	ND	ND
120 return vent	ND	ND	ND
120 floor by bed	positive	positive	23,000
120 window shelf	positive	positive	820

ND= no result over background by RT-PCR

No covid-19 was detected on the supply air diffuser in either room. This appears to indicate that for these rooms, covid-19 RNA was not being supplied into the room from the mechanical ventilation system. The only sources for the SARS-CoV-2 virus would have been from the patient shedding virus[10], staff, and potentially from the hallway.

The highest level of detected covid-19 was detected in room 120 on the floor by the patient bed. This demonstrates that the patient in 120 was actively shedding virus and droplets from the patient were the likely source. Analysis of the sample from the floor in room 118, at the same location, did not show any covid-19. This could be due to the fact that the patient had stopped shedding virus[11] or that the floor by the bedside had been recently cleaned.

[10] The most likely source of cvid-19 RNA in the room is the patient shedding virus. Staff were tested at least weekly prior to and during this study. Staff who tested positive were sent home for isolation.
[11] The patient in room 118 was released from 14-day quarantine on 19 November as the testing concluded

The second highest result was from sampling the return air vent in room 118. From this datum it can be surmised that:

- The covid-19 positive resident in room 118 was shedding at some time during the 14-day isolation period
- Resident virus shedding included airborne particulates since the return air vent was over six feet from the patient and the return vent is in the ceiling. The distance and location of the return air vent, as compared with the resident, likely eliminates the presence of ballistic droplets on the return air vent.
- Airflow patterns in the room support the detection of covid-19 on the return air vent surface. The supply diffuser was located near the resident and the return air vent was located near the hallway door. The natural airflow pattern would be from the supply diffuser towards the hallway and return air vent.
- A sufficient concentration of airborne covid-19 was present in room 118 in order to collect on the return air vent and be detected on a swab sample

The third highest result for covid-19 came from the window shelf directly across from the patient in room 120. Papers, a cell phone, and writing implements were scattered about this window shelf. Since the floor by the bed indicated that the patient was actively shedding virus, a positive result on the window shelf was not surprising.

Not finding covid-19 on the return air vent in room 120 was, however, surprising. Based on the above discussion, it is believed that the resident in room 120 was actively shedding virus. It is also apparent that airborne covid-19 could reach the return air vent based on the room 118 results. In room 120, however, the Halo HEPA filtration unit was placed on the ceiling between the resident and the return air vent. Since the HALO unit was the only apparent significant airflow difference between the rooms, these data indicate[12] that airborne covid-19 may not have reached the room 120 return air vent due to the presence of the Halo HEPA filter. At a rate of approximately 130 cubic feet/minute, the Halo HEPA filtration unit actively pulls air from approximately one foot below the ceiling, filters it through the sealed HEPA filter, and returns air which is particulate free air into the room.

The negative covid-19 data from room 118 in Table IV appear to support the idea that the room 118 resident was not actively shedding virus during this study. The floor and window surface data from room 120, however, support the conclusion that the resident in room 120 was actively shedding. Finding covid-19 on the return air vent in room 118 but none on the return air vent in room 120 suggests that that covid-19 was airborne in room 118 and that if airborne in room 120 (likely) it did not reach the return air vent.
The presence of the Halo HEPA unit can explain these results; however, additional testing is recommended to support this conclusion.

Several organizations[13] have addressed ventilation issues which should be considered in an overall plan to mitigate airborne disease transmission in long-term care facilities. Ventilation issues are, of course, layered on top of basic infection control procedures

[12] Data represent one set of covid-19 positive patients. To demonstrate reproducibility, this study should be repeated with both surface and air sampling for covid-19 followed by RT-PCR analysis.
[13] ASHRAE 2020, American Industrial Hygiene Association (AIHA) 2020, CDC/NIOSH 2020

including face coverings, social distancing, hand washing, managing visitors, staff PPE, and surface cleaning.

ASHRAE and AIHA broadly agree on the following:

- MERV 13 or higher rated filters should be used in mechanical ventilation systems
- Air changes per hour should be increased to 6-12 ach
- Outside air intake into the mechanical ventilation (HVAC) system should be maximized
- Use of HEPA filtration units (e.g., ceiling mounted) for air purification in smaller rooms should be considered

Once MERV filters are addressed, increasing air changes per hour and outside air infusion can be difficult for older facilities to accomplish based on limitations of older HVAC systems, lack of automated HVAC controls, lack of data regarding airflow balancing and air exchange rates, and various cost considerations. In-room air purification remains an important option for these LTHC facilities to reduce the airborne viral load– for resident rooms, resident and staff common areas, and staff/administrative offices.

Note that these considerations are not specific to the SARS-CoV-2 virus but are applicable to any disease or situation that can cause exposure or secondary infections through airborne transmission. This would include other SARS viruses, influenza, measles, wildfire smoke contamination which can adversely affect long-term care facility patients, and other airborne pathogens.

Please contact me with any questions regarding this report.

Michael N. Cooper MS, MPH, NRRPT, CIH
Certified Industrial Hygienist
Industrial Hygiene Resources Ltd.
mcooper@industrialhygieneresources.com
(408) 313-2127

Attachments:

A. Photo Log
B. Laboratory Reports
   - Prestige Laboratory Report – PCR Analysis
   - EAA Laboratory Report – Particle Analysis

Attachment A. Photo Log

Photo 1 HVAC unit feeding rooms 120 and 118, note closed outside air intake louvers

Photo 2 Return air vent in room 120- grill removed

Photo 3 Inside of return air duct in room 120 - note insulation on the duct interior

Photo 4 Ceiling mounted Halo HEPA filtration unit in room 120

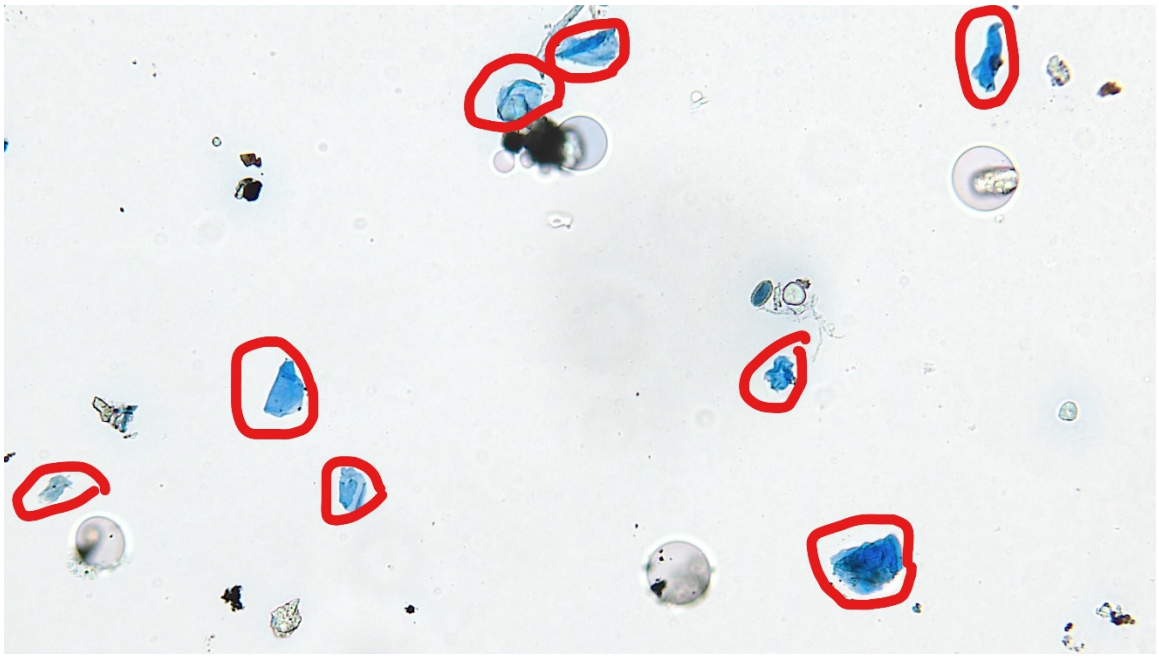


Photo 5 Microscope photograph of skin cells (red circles) identified in room 118

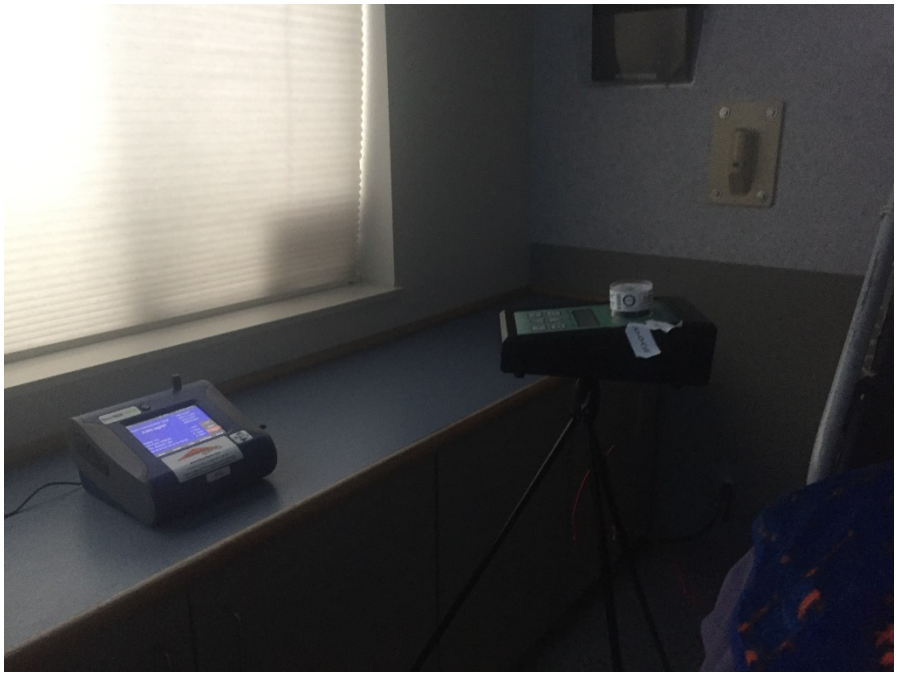


Photo 6 Collection of particulate size data and dust analysis data in room 120

Photo 7 Supply diffuser in room 118 – staff is shown in photo

Photo 8 Halo unit suspended in room 120 with return air vent in the foreground – the supply diffuser can be seen on the ceiling past the smoke alarm

Attachment B. Laboratory Reports

Prestige EnviroMicrobiology, Inc.

Analytical Test Report

Client: Industrial Hygiene Resources, 8312 W. Northview St., Suite 100, Boise, Idaho 83704

Client Project/Name: IHR 6600

Sample date: 11-18-2020

Submittal date: 11-18-2020

Sample received: 11-19-2020

Samples submitted by: Mike Cooper

Date analysis completed: November 20, 2020

Prestige Report number: 201119-03

RT-PCR 2019-nCoV: Analysis of Swab samples for the detection of SARS-CoV-2 Genetic Markers

Prestige # Client sample ID Location	2019-nCoV (N1 Protein)	Cycle Threshold (Ct) Value[3] (N1 Protein)	2019-nCoV (N2 Protein)	Cycle Threshold Value[3] (N2 Protein)	Conc. (copies of RNA/sample)
201119-03-027 120 Supply Supply Register	ND	ND	ND	ND	NA
201119-03-028 120 Return Return Register	ND	ND	ND	ND	NA
201119-03-029 120 Floor Patient Side	**Positive**	**31.81**	**Positive**	**32.18**	**23,000**
201119-03-030 120 Desk Shelf by Window	**Positive**	**38.23**	**Positive**	**38.95**	**820**
201119-03-031 118 Supply Supply Register	ND	ND	ND	ND	NA
201119-03-032 118 Return Return Register	**Positive**	**36.36**	**Positive**	**36.01**	**3,500**
201119-03-033 118 Floor Patient Side	ND	ND	ND	ND	NA
201119-03-034 118 Desk Shelf by Window	ND	ND	ND	ND	NA

Report approved: Theresa Lehman

Theresa Lehman, MPH, Lab Director

Technical Manager: _____

Chin S Yang, Ph.D.

Analyst: Ching-Yi Tsai, Ph.D.

1. The samples in this report were received in good, acceptable conditions. Results relate only to the items tested.
2. The primers and probes in 2019-nCoV CDC EUA Kit are designed for the detection of the two SARS-CoV-2 genes that encode for the N1 and N2 proteins. The kit is manufactured and supplied by Integrated DNA Technologies and approved by the U.S. Centers for Disease Control and Prevention (CDC). Three controls, two positive controls for N proteins and one internal control for the RNA extraction process, are simultaneously run with the samples.
3. Cycle Threshold Value refers to the number of cycles required for the fluorescent signal to cross the detectable threshold in Reverse Transcriptase Polymerase Chain Reaction (RT-PCR); a lower cycle threshold value indicates a higher viral load.
4. ND = not detected, no genetic marker is detected within 40 PCR cycles. NA = not applicable. The detection limit is 10 copies/reaction.
5. Sampling reference: Rahmani, A. R., M. Leili, G. Azarian, A. Poormohammadi. 2020. Sampling and detection of corona viruses in air: A mini review. Science of the Total Environment. https://doi.org/10.1016/j.scitotenv.2020.140207

EAA Project # : 20-1515 *(Lab use only)*

Environmental Analysis -SAMPLE COLLECTION / CHAIN OF CUSTODY FORM

Your Contact Information		Your Project Information	
Company name:	IHR Boise	Client Proj.# :	IHR 6600
Address:	8312 W Northview #100	Proj. Descrip. :	Avemere
City/State/Zip :	Boise, ID 83704		
Phone # :	(408) 313-2127	EAA-Invoice to:	☐ Same ☐ Different - Provide below
Email address :	Mlooper@industrialhygieneresources.com	Special Instructions	Need photos
Date collected :	11-18-2020		
Date Submitted :	11-18-2020		
Contact Name :	MIKE Cooper		

Optical Microscopy - Mold & Dust

Analysis requested *Check appropriate boxes, or describe if the analysis is different* photos

Air / Air-O-Cell	Surface / Bulk / Tape	Electron Microscopy
☐ Airborne mold	☐ Mold only - tape (Qualitative)	☐ Bulk SEM / X-ray analysis only
☒ Airborne mold & dust	☐ Mold only - bulk (Qualitative)	☐ Automated air or dust particle analysis
☐ Airborne dust/fire residue	☐ Surface mold tape (cts/mm²)	☐ Automated Fire chemistry analysis
☐ Airborne fiberglass only	☐ Quantitative dust (cts/mm²)	☐ Quantitative sample analysis (hourly)
☐ Other:	☐ Quantitative dust/fire residue (cts/mm²) (Fire Type - Wildfire - Structure fire - Protein Fire)	☐ Other / describe:
	☐ pH analysis (wildfire)	
☒ Photo report	☐ Total Coliform / E. coli	

Analysis Turnaround ☒ **Standard - 5 Day** ☐ **Rush 24 hr. 50% surcharge*** ☐ **Same day 100% surcharge***

** Must notify EAA in advance - Limit on number of rush samples that maybe completed in a given day. Turnaround Time (TAT) is measured in full business days; for example, samples arriving today for 24hr TAT are due at the next business day, excludes weekends and holidays.*

EAA# lab use only	Sample #	Description / Location	Analysis (if different from above)	Vol. (liters)
1	118 α	Patient / shelf	mold / dust +	
2	118 β	Patient / shelf #2	photos	
3	120 α	Patient / shelf		
4	120 β	Patient / shelf #2		
		Looking for any difference between 118 and 120 sampler		
5	120 γ	Near supply unoccupied		
6	~~120~~ 118 ε	Near supply occupied		

ENVIRONMENTAL ANALYSIS ASSOCIATES, INC.- Shipping Location Information
(All samples should be sent to Michigan unless otherwise discussed)

Michigan Lab ☒ **Attn: Joseph Heintskill**
306 5th Street, Suite 2A
Bay City, MI 48708
(989) 895-4447

San Diego - Forensic Research Lab ☐ **Attn: Daniel Baxter**
Please call before sending to San Diego Lab
(858) 272-7747

Relinquished / received (Signature)	Printed Name	Company	Date	Time
MN Cooper	MN Cooper	IHR	11-18-20	1500
Emmalee Richardsen	Emmalee Richardsen	EAA	11/23/20	8:00 AM

CONTRACT TERMS

By providing signature authorization, the client acknowledges this contract is entered into, and the lab work will be performed in either San Diego, California or Bay City, Michigan. This signature binds the submitting company to provide payment for services according to EAA's fee schedule within 30 days above from receipt of the project invoice. A 1% finance charge per month will be charged on overdue invoices. Sample archive policy: EAA retains and holds samples for a time period of 3 weeks only. If samples need to be retained by the laboratory for a longer period of time, you must make arrangements for retention at the time of sample submission. Additional charges may apply.

ENVIRONMENTAL ANALYSIS ASSOCIATES, INC. - 306 5th Street, Suite 2A - Bay City, MI 48708

AIRBORNE MOLD AND DUST ANALYSIS

EAA Method # : DUST-A01

Client Name : IHR Boise
Client Project # : IHR 6600 — Project description : Avemere
Requested by : Mike Cooper — Date collected : 11/18/20
EAA Project# : 20-1515 — Sample received : 11/23/20

Sample condition : *Acceptable as received*

Client Sample#	Sample Description / Location	* General Comments - Dust and Mold Spore Levels	
118a	Patient/shelf	Typical dust	Typical mold spores
118b	Patient/shelf #2	Typical dust	Typical mold spores
120a	Patient/shelf	Typical dust	Typical mold spores
120b	Patient/shelf #2	Typical dust	Typical mold spores
120y	Near supply unoccupied	Typical dust	Typical mold spores

AIRBORNE MOLD SPORE CONCENTRATIONS (Cts./m^3) -- Spore Trap Sample Analysis *High mag. used 500X*

Category **Sample # -->**	**118a**	**118b**	**120a**	**120b**	**120y**
Total Mold Spores (Cts/m^3)	**91**	**334**	**425**	**91**	**137**
Alternaria		14			
Aspergillus/Penicillium		46			46
Pigmented Asco & Basidio		46	46		
Mix tiny, hyal Asco & Basidio	46	46	183	46	
Botrytis					
Chaetomium					
Cladosporium		46			46
Curvularia					
Drechslera/Bipolaris					
Epicoccum					
Fusicladium-like					
Nigrospora					
Oidium/Peronospora					
Pithomyces					
Rusts			14		
Smuts / Myxomycetes / Periconia	46	137	183	46	46
Stachybotrys					
Stemphylium					
Torula					
Ulocladium					
Other Hyaline Fungi					
Other Fungi					
Unidentified Fungi					
Hyphae fragments		46			
Algal / fern spores					
Insect parts					
POLLEN (Total cts/m^3)	**13**	**not detected**	**not detected**	**13**	**not detected**
Not specified	13			13	
Pinus					
COMMON AEROSOLS (cts/m3)					
Skin cell fragments	823	3110	1830	1740	5030
Fiberglass fibers					
Cellulosic / synthetic fibers	91	274	91	183	91
Unidentified opaque	640	6130	2100	1600	1690
Mineral / clay soil dust	1100	3430	1920	1830	4160
OTHER PARTICLES (cts/m3)	**not detected**	**not detected**	**not detected**	**not detected**	**not detected**
Statistical Parameters	91			91	91
Vol. analyzed (m3)-high mag - 500x :	0.022	0.022	0.022	0.022	0.022
Detect limit(Cts/m^3)-high magnification:	45.7	45.7	45.7	45.7	45.7
% sample analyzed-high magnification:	29%	29%	29%	29%	29%
Vol. analyzed(m^3)/entire sple 150-300x:	0.075	0.075	0.075	0.075	0.075
* Detection limit (Cts/m^3)/entire sple:	13.3	13.3	13.3	13.3	13.3
* Note: The "entire sample" detection limit applies to the "large" particle categories analyzed during the low magnification examination of the entire sample					
Sample flow rate (lpm):	15.0	15.0	15.0	15.0	15.0
Sample trace length (mm):	14.40	14.40	14.40	14.40	14.40
Microscope field diameter (mm):	0.420	0.420	0.420	0.420	0.420

Note: Sample results are only applicable to the items or locations tested. Sample descriptions and volumetric data are provided by the client.

doc.rev.2020-19.1 4/10/20

** See the **AIR PROFILE** ™ Interpretation Guidelines for the appropriate application of the exposure classification definitions of Typical, Atypical, and Elevated.*

Raw/extrapolated counts are given on the last page of this report as a requirement of the AIHA-LAP accreditation program

Authorized / data reviewed by: *Joseph R. Heintskill*

Analyst : *jrh*

Report date: **11/24/20**

Date analyzed: 11/24/20

AIRBORNE MOLD AND DUST ANALYSIS

Client Name : IHR Boise
Client Project # : IHR 6600
Requested by : Mike Cooper
EAA Project# : 20-1515

Project description : Avemere
Date collected : 11/18/20
Sample received : 11/23/20

Sample condition : *Acceptable as received*

Client Sample#	Sample Description / Location	* General Comments - Dust and Mold Spore Levels	
118y	Near supply occupied	Typical dust	Typical mold spores

AIRBORNE MOLD SPORE CONCENTRATIONS (Cts./m^3) -- Spore Trap Sample Analysis *High mag. used 500X*

Category **Sample # -->**	**118y**
Total Mold Spores (Cts/m^3)	**46**
Alternaria	
Aspergillus/Penicillium	
Pigmented Asco & Basidio	
Mix tiny, hyal Asco & Basidio	46
Botrytis	
Chaetomium	
Cladosporium	
Curvularia	
Drechslera/Bipolaris	
Epicoccum	
Fusicladium-like	
Nigrospora	
Oidium/Peronospora	
Pithomyces	
Rusts	
Smuts / Myxomycetes / Periconia	
Stachybotrys	
Stemphylium	
Torula	
Ulocladium	
Other Hyaline Fungi	
Other Fungi	
Unidentified Fungi	
Hyphae fragments	
Algal / fern spores	
Insect parts	
POLLEN (Total cts/m^3)	**not detected**
Not specified	
Pinus / other	
COMMON AEROSOLS (cts/m3)	
Skin cell fragments	4020
Fiberglass fibers	
Cellulosic / synthetic fibers	229
Unidentified opaque	2190
Mineral / clay soil dust	1970
OTHER AEROSOLS (cts/m3)	**not detected**

Statistical Parameters	
Vol. analyzed (m3)-high mag - 500x :	0.022
Detect limit(Cts/m^3)-high magnification:	45.7
% sample analyzed-high magnification:	29%
Vol. analyzed(m^3)/entire sple 150-300x:	0.075
* Detection limit (Cts/m^3)/entire sple:	13.3

* Note: The "entire sample" detection limit applies to the "large" particle categories analyzed during the low magnification examination of the entire sample

Sample flow rate (lpm):	15.0
Sample trace length (mm):	14.40
Microscope field diameter (mm):	0.420

Note: Sample results are only applicable to the items or locations tested. Sample descriptions and volumetric data are provided by the client. *doc.rev.2020-19.1 4/10/20*

** See the **AIR PROFILE** ™ Interpretation Guidelines for the appropriate application of the exposure classification definitions of Typical, Atypical, and Elevated.*

Raw/extrapolated counts are given on the last page of this report as a requirement of the AIHA-LAP accreditation program

Authorized / data reviewed by: *Joseph R. Heintskill*
Analyst: *jrh*

Report date: **11/24/20**
Date analyzed: 11/24/20

AIRBORNE MOLD AND DUST ANALYSIS

(Mold and Dust Comparison Summary - Cts/m^3)

Client Name : IHR Boise

Client Project # : IHR 6600 Project description : Avemere

Requested by : Mike Cooper EAA Project# : 20-1515

Sample # Description	Mold Spores * Total	Chronic Aspergillus / Penicillium	Chronic W.I. Fungi	Chronic Outdoor Spores	Chronic Hyphae Fragments	Pollen	Skin cell Fragments	Fibrous Dust Min. wool / Fiberglass	Fibrous Dust Cellulose/ Synthetic	Non-Fibrous dust Unident. Opaque	Non-Fibrous dust Crystalline Minerals	Other Particles
118a Patient/shelf	91			91		13	823		91	640	1,100	
118b Patient/shelf #2	334	46		288	46		3,110		274	6,130	3,430	
120a Patient/shelf	425			425			1,830		91	2,100	1,920	
120b Patient/shelf #2	91			91		13	1,740		183	1,600	1,830	
120y Near supply unoccupied	137	46		91			5,030		91	1,690	4,160	
118y Near supply occupied	46			46			4,020		229	2,190	1,970	

** Note : All individual particle category values are rounded to 3 decimal places. As a result, individually summed mold categories may appear slightly different than the "Total" value*

Chronic water indicating fungi (W.I.), include the genera Chaetomium, Stachybotrys, Ulocladium, and Trichoderma. The hyphae fragments category includes hyphae (mycelia), phialides, perithecia, etc. In order for chart clarity, cells where the particle category was not detected are intentionally left blank.

*The **AIR PROFILE**™ reporting format developed by EAA is a systematic and statistically concise way to summarize and compare your indoor sampling data, with historical indoor data collected from a large database of other buildings (as recommended by the 1999 ACGIH document,"Bioaerosols Assessment and Control"). The color-coded exposure ranges used by EAA are Typical-1, Typical-2, Atypical-3, Atypical-4, Elevated-5, and Elevated-6. The ranges are based on the percentile frequency of occurrences measured from the EAA 2017/2018 database of over 3,500 residential and commercial building samples collected throughout the United States. The resulting data should be used in combination with a thorough visual inspection conducted by a qualified environmental professional to determine if an indoor air quality problem is present.*

Range	Percentile
Elevated - 6	>99%
Elevated - 5	>95%
Atypical - 4	>90%
Atypical - 3	>75%
Typical - 2	>50%
Typical - 1	<50%

IMPORTANT: Laboratory results are secondary information used to support a thorough visual inspection performed by a qualified environmental professional. The EAA concentration range definitions and color-coding (*Typical*, *Atypical*, or *Elevated*), are to be used for a comparison with historical data only. The individual sample results or descriptive ranges cannot be used as the sole criteria to determine if a "safe", "unsafe", or "elevated" condition exists at any specific location.

The ***AIR PROFILE***™ guidelines developed by Environmental Analysis Associates, Inc. (EAA) use industry accepted statistical methods to compare indoor airborne sampling data collected from your project, with a large database of over 3,500 indoor samples collected from other commercial and residential buildings. A statistical summary of the data used to develop these guidelines is provided on the News and Information page of our web-site at eaalab.com**.** Because no industry recognized standards or published threshold mold exposure levels currently exist, performing a statistical comparison with historical indoor data collected from similar control and "problem" buildings is the best approach.

The American Conference of Governmental Industrial Hygienists (ACGIH) suggests using the 90th or 95th percentiles of baseline data (and not the arithmetic mean levels) as more appropriate metrics to assess potential exposure. This approach is described in Chapter 14.2.3.1 of the 1999 ACGIH publication entitled "*Bioaerosols Assessment and Control*". A similar approach was also used in our AIHA 2005 publication entitled *"A Regional Comparison of Mold Spore Concentrations Outdoors & Inside Clean and Mold Contaminated Southern California Buildings".*

The EAA ***AIR PROFILE***™ interpretation guidelines use our own database of over 3,500 indoor samples collected in 2017 and 2018 from the West Coast, Midwest, and East Coast regions of the country. The spore concentrations are classified into six (6) percentile frequency of occurrence ranges commonly applied to statistical exposure assessments using environmental data. The color-coded percentile ranges defined by EAA are *Typical-1* (<50th), *Typical-2* (50-75th), *Atypical-3* (75-90th), *Atypical-4* (90-95th), *Elevated-5* (95-99th), and *Elevated*-6 (>99th). The descriptive ranges and color-coding are not intended to represent or infer safe or unsafe levels. They are simply a systematic way to compare airborne mold spore concentrations collected from your building, with historical measurements from other buildings. According to the 1999 ACGIH publication, Chapter 14.2.3.1, "*investigators might decide that the new data must exceed the 90th or 95th percentile of the baseline data (non-problem environments) to be considered indicative of a potential for harm".* This is a decision to be made by a trained environmental professional, and only after placing the laboratory data in context with the site-specific inspection observations made during a thorough visual inspection.

The variability in building construction, usage, and HVAC filtration need to be considered when performing any comparison. Site-specific climatic conditions can also have a direct impact on the infiltration rate and measured background of mold spores found inside buildings. The amount of vegetation in close proximity to a building can also potentially impact mold spore levels measured inside of a building through infiltration. The majority of samples in the EAA database were collected as a direct response to an indoor air quality complaint (i.e. potentially a "problem" building). As a result, there is positive bias of what the 1999 ACGIH publication refers to as "problem" buildings over "non-problem" buildings. As with most IAQ investigations there is also a third "not determined" classification that includes buildings where the specific complaints are found to be unrelated to mold or dust levels, or are simply unknown. Therefore, the exact ratio of "non problem", "problem", and "not determined" building classifications can only be theoretically estimated. The estimates for each building type are given at the bottom of last page of these guidelines.

Mold Spore Category	Description / Definition
Total Mold Spores	Total concentration of all enumerated mold spores
Aspergillus/Penicillium	Mold spores with Penicillium or Aspergillus morphology (the most common molds associated with indoor growth)
Chronic Water Indicating Fungi	Hydrophilic mold genera associated with "chronic" indoor moisture (Stachybotrys, Chaetomium, Ulocladium, Trichoderma)
Typical Outdoor Fungi	Mold genera commonly found in outdoor air (Asco/Basidiospores, Cladosporium, and other listed spores)
Hyphae fragments	Mold growth structures including hyphae (mycelia), phialides, perithecia, etc.

Note: Cladosporium may commonly grow indoors in sub-tropical climates as well as inside HVAC systems, and on window panes (from condensation). All molds genera listed can be found both indoors and outdoors. Finding low or isolated spores of any genera should be viewed as normal occurrence.

The ***AIR PROFILE***™ Comparison Summary Table in this report combines the molds into three (3) categories. The first category includes the mold genera commonly associated with outdoor infiltration including Ascospores, Basidiospores, Cladosporium, etc. The second category includes genera commonly associated with indoor growth (e.g. Aspergillus/Penicillium). The third category includes the hydrophilic "water-indicating" molds (primarily Stachybotrys, Chaetomium, Ulocladium, Trichoderma). These mold genera are common indicators of long-term water saturation or prolonged humidity. The water-indicating molds, especially Stachybotrys, are typically found at significantly lower airborne concentrations (and frequency of detection) when compared to other mold genera, even when the levels fall into the "Elevated" classifications. These separate classifications of mold genera allow the results from any building to be directly compared with the database of indoor samples independent of a comparison with outdoor sampling data. These categories are ranked by their percentile frequency of occurrence found in our 2017-2018 historical database as described above. The definition of the percentile frequency of occurrence is explained on the following page. The Aspergillus/Penicillium and Water-Indicating mold categories are commonly used as airborne indicators for the likely presence or absence of potential indoor mold growth sources. The "Outdoor Mold" category is often used as an indicator to determine if the airborne mold spores found indoors are more likely from outdoor infiltration. As stated previously, laboratory data should only be used as secondary information to support a thorough visual inspection.

Note: The guidelines are only applicable to occupied spaces and do not apply to wall cavities, attics, unfinished basements, crawl spaces, or other confined spaces.

AIR PROFILE™ INDOOR AIRBORNE MOLD SPORE CLASSIFICATION GUIDELINES

2017-2018 Nationwide Database - Residential and Commercial Buildings (Mold spores/m^3)

Classification/Level		Percentile Ranking	Total Spores	Aspergillus/ Penicillium	Water Indicating	* Outdoor Spores	Hyphae Fragments	Algal / Fern spores	Insect Parts
Elevated	6	>99%	>40000	>21000	>230	>16000	>340	>950	>1000
Elevated	5	>95%	>12000	>3500	>90	>8000	>170	>500	>500
Atypical	4	>90%	>6200	>1000	>50	>5000	>60	>240	>200
Atypical	3	>75%	>1600	>140	>20	>1500	>30	>140	>100
Typical	2	>50%	>400	>40	>10	>360	>15	>100	>60
Typical	1	<50%	<400	<40	<10	<360	<15	<100	<60

The concentrations in each category have been "rounded off" from the actual data generated within the 2017-2018 database

** Outdoor spores are extrapolated by not including the Aspergillus/Penicillium and Water Indicating spore categories.*

Classification/Level		Explanation	Descriptive Comments / Likely Conditions
Elevated	6	*Range found in <1% of buildings (>99th percentile)*	*Indoor mold growth / amplification and/or inadequate cleaning likely present*
Elevated	5	*Range found in <5% of buildings (>95th percentile)*	*Indoor mold growth / amplification possible, or high outdoor infiltration*
Atypical	4	*Range found in <10% of buildings (>90th percentile)*	*Infrequent cleaning, outdoor mold infiltration, isolated mold growth possible*
Atypical	3	*Range found in <25% of buildings (>75th percentile)*	*Infrequent cleaning, moderate outdoor mold infiltration*
Typical	2	*Range found in >50% of buildings (>50th percentile)*	*Typical / average buildings*
Typical	1	*Range found in <50% of buildings (<50th percentile)*	*Typical / below average building*

Although no classification system may be appropriate for all buildings, using the statistical percentile frequency of occurrence ranges as an exposure evaluation metric is consistent with industry recommended guidelines. Using this statistical method (instead of calculating the arithmetic average) ensures that a singular building with very high spore concentrations will not statistically "over-represent" buildings with very low spore concentrations. The percentile frequency of occurrence analyzes the range of collected airborne concentration measurements and determines the concentration at which a defined percentage of measurements are above and below a specified "percentile" value. For example, the 50th percentile is the value at which 50% of all measurements are both above and below that value. EAA has assigned both color-coded statistical frequency ranges and descriptions to classify exposure as shown above. The database includes ~3,500 indoor samples collected in "problem" and "non-problem" *occupied* buildings that ranged from being "clean", to having isolated water damage and/or visible mold growth. Over 1,500 outdoor samples were also collected as a part of the database. This data is summarized in a separate document. An indoor/outdoor comparison with a sub-set of this data has confirmed that a statistical correlation between simultaneously collected indoor and outdoor mold spore concentrations does not exist. In other words, using outdoor data as an acceptance/rejection or as a baseline "control" for indoor data is inherently unreliable. Outdoor samples are helpful in determining if the genera typically found outside are infiltrating into the building environment.

INTERPRETING THE INDOOR AND OUTDOOR AIRBORNE MOLD SPORE DATA IN YOUR REPORT

As described above, there is no simultaneous short-term relationship between indoor and outdoor mold/fungal spore concentrations. Using outdoor mold levels as a primary baseline comparison with indoor levels is inherently unreliable and should not be used. Outdoor airborne mold spore concentrations can vary 10-100 fold (e.g. 100 - 10,000 cts/m^3) on an hour-by-hour basis depending on the sampling location, meteorological conditions, time of day, wind velocity, and seasonal variability. The indoor environment has a fewer number of variable conditions. Mold spore concentrations will typically vary no more than 2-5 fold (e.g. 500 - 2,500 cts/m^3) over several weeks. The 1999 ACGIH Bioaerosols publication clearly states in Section 14.2.3.2 that *"Investigators cannot view single, paired, short-term indoor and outdoor samples as sufficiently accurate measures of fungal concentrations to allow meaningful comparisons".* Although indoor mold spore concentrations are typically lower than the "average" outdoor levels, higher measured spore concentrations indoors (even in the absence of indoor mold growth sources) is a common and normal occurrence. This is especially true in desert areas, or in northern climatic zones where vegetation sources vary significantly on a seasonal basis. Outdoor mold spore measurements are most effectively used as a potential indicator of outdoor infiltration into the indoor environment.

SUGGESTED ACTION GUIDELINES BASED ON THE MEASURED PERCENTILE EXPOSURE RANGES

1). When measurements are below the 50th percentile (Typical-1), the data should be considered typical/below average for all types of buildings.

2). When measurements are between the 50th and 75th percentile (Typical-2), the data should be considered typical/average for most HVAC supplied buildings.

3). When multiple measurements are found to be above the 75th percentile (Atypical-3), the data should be considered atypical and marginally above levels found in average buildings (HVAC and non-HVAC supplied). Further investigation may also be warranted.

4). Individual measurements exceeding the 90th (Atypical-4) or 95th percentile (Elevated-5), should be considered atypical in average buildings. The data may indicate potential indoor mold amplification or an unusual site-specific condition. Further investigation may be warranted.

5). Individual measurements above the 99th percentile (Elevated-6) should be considered a likely indicator of indoor mold amplification and require further investigation and/or remedial actions. Recommending and/or implementing additional actions requires professional judgement.

Note: The guidelines given above cannot be used to directly assess wall cavities, attics, unfinished basements, crawl spaces, or other confined spaces.

1999 -ACGIH, Bioaerosols: Assessment and Control (Chapter 14)

2005 JOEH, 2: 8-18, Daniel M. Baxter, Jimmy L. Perkins, "A Regional Comparison of Mold Spore Concentrations Outdoors and Inside "Clean and "Mold Contaminated" Southern California Buildings."

2017-2018 - Environmental Analysis Associates Database Statistical Summary (available on our website at eaalab.com)

AIR PROFILE ™ **INDOOR AIRBORNE DUST INTERPRETATION GUIDELINES**

Based on the Environmental Analysis Associates, Inc. 2017/2018 Air Sample Database

The indoor ***AIR PROFILE***™ classification system used by EAA provides a systematic way to measure and evaluate the most common particles generated by building occupants, renovation and maintenance activities, HVAC corrosion and degradation, and the filtration efficacy in a building. This is accomplished by understanding the origin of the most common types of indoor airborne dust particle contaminants. Based on our own historical building inspections, and using the 2017/2018 historical sample database, the measured dust particle concentrations are classified in six (6) ranges (as described above) including *Typical -1* , *Typical - 2* , *Atypical -3* , *Atypical - 4* , *Elevated - 5* , and *Elevated - 6* based upon their respective percentile frequency of occurrence. In the case of "non-mold" dust categories, *Elevated* levels are usually generated by occupant or renovation activity, building component corrosion, and/or the high infiltration and prolonged deposition of outdoor dust sources. These ranges are not direct indicators of safe or unsafe conditions, nor should they be confused with EPA or OSHA exposure guidelines. The origin and potential impact of each particle category on indoor air quality is described and illustrated in Version 7 of the EAA "***Airborne and Surface Dust Analysis Interpretation Guide***" available for download on the News and Information page of our website located at eaalab.com. Additional analysis of the particle size distribution and inorganic particle chemistry can also be provided by automated SEM / X-ray analysis. The automated SEM / X-ray analysis method is also described in the airborne and surface dust interpretation guide.

The ***AIR PROFILE***™ particle classifications used by EAA are given below:

CLASSIFICATION	DESCRIPTION
Pollen	Reproductive spores of flowers
Skin cell fragments	Epithelial cells / dander
Fiberglass	Man-made fibrous glass fibers (fiberglass, mineral wool, ceramic)
Cellulose / Synthetic	Cellulosic, fabric, synthetic fibers (nylon, rayon, etc.)
Unidentified Opaque	Opaque debris (biological decay, tire rubber, corrosion, paint, etc.)
Mineral (crystalline)	Crystalline / soil minerals, construction dust particles
Fire residue	Combustion soot, ash, char, other assemblage indicator particles
* Other	Specific unusual and atypical particles
	Examples: Copier toner, paint flakes, unusual fibers, feather fibrils, starch grains, etc.
	To be handled on a case-by-case basis
(Not quantified in the summary report tables)	
Algae / Fern spores	Reproductive spores from other types of vegetation
Insect parts	Wing scales, leg or body parts of insects

AIR PROFILE™ INDOOR AIRBORNE DUST CLASSIFICATION GUIDELINES

2017-2018 Nationwide Database - Residential and Commercial Buildings (Cts/m^3)

Classification/Level		Percentile Ranking	Pollen	Skin Cell Fragments	Fiberglass	Cellulose / Synthetic Fibers	Unidentified Opaque	Soil / Crystalline Minerals	Fire residue / Other Particles
Elevated	6	>99%	> 40	> 30000	> 650	> 5900	> 41000	> 132000	> 54000
Elevated	5	>95%	> 35	> 15000	> 90	> 1800	> 13000	> 41000	> 9000
Atypical	4	>90%	> 16	> 10000	> 30	> 1100	> 8000	> 22000	> 4000
Atypical	3	>75%	> 8	> 6000	> 15	> 600	> 4000	> 9000	> 1400
Typical	2	>50%	> 4	> 3000	> 7	> 300	> 1800	> 4000	> 500
Typical	1	<50%	< 4	< 3000	< 7	< 300	< 1800	< 4000	< 500

The concentrations in each category have been "rounded off" from the actual data generated within the 2017-2018 database

Classification/Level		Explanation	Descriptive Comment (Most Likely Condition)
Elevated	6	*Range found in <1% of buildings (>99th percentile)*	*Significant indoor generating sources and/or outdoor infiltration present*
Elevated	5	*Range found in <5% of buildings (>95th percentile)*	*Indoor generating source and/or outdoor infiltration likely present*
Atypical	4	*Range found in <10% of buildings (>90th percentile)*	*Possible indoor generating source, infrequent cleaning, inadequate filtration*
Atypical	3	*Range found in <25% of buildings (>75th percentile)*	*Above average - Infrequent cleaning, high occupancy, outdoor infiltration*
Typical	2	*Range found in >50% of buildings (>50th percentile)*	*Average / typical building*
Typical	1	*Range found in <50% of buildings (<50th percentile)*	*Below average "typical" non-impacted building*

Although no exposure classification system can accurately represent all building conditions, EAA's system follows statistical guidelines outlined in Chapter 14.2.2 of the ACGIH 1999 document "*Bioaerosols: Assessment and Control*" for the comparison of airborne data. Average levels measured inside high occupancy buildings (e.g. auditoriums, classrooms, etc.), industrial environments, or buildings without routine HVAC supplied air, may have higher average ranges than indicated above. Furthermore, these guidelines are not directly applicable to the evaluation of confined spaces such as wall cavities, attics, crawl spaces, garages, or unfinished basements.

AIR PROFILE™

INDOOR AIRBORNE EXPOSURE CLASSIFICATION SYSTEM

Indoor Airborne Mold Spore and Dust Concentrations By Region (Cts/m^3)

(Combined Commercial and Residential Buildings)

AVERAGE NATIONWIDE INDOOR PERCENTILE RANKING DATA - (Used in the EAA Comparison Summary Report)

Classification	Percentile	Total	Asp/Pen	WI	* OS	HYP	Al/Fn	Insect	Pollen	SCF	FG	CE/SYN	OPA	MIN	Fire
Elevated - 6	**>99%**	**37562**	**21555**	**233**	**15774**	**338**	**949**	**1051**	**37**	**29900**	**648**	**5894**	**41325**	**132580**	**54589**
Elevated - 5	**> 95%**	**11670**	**3488**	**91**	**8091**	**169**	**474**	**526**	**13**	**14700**	**85**	**1780**	**12700**	**41290**	**9588**
Atypical - 4	**> 90%**	**6116**	**1010**	**46**	**5060**	**57**	**237**	**179**	**7**	**9600**	**29**	**1140**	**7850**	**22160**	**4323**
Atypical - 3	**> 75%**	**1640**	**137**	**23**	**1480**	**29**	**137**	**60**	**3**	**5723**	**8**	**611**	**3670**	**9090**	**1467**
Typical - 2	**> 50%**	**395**	**18**	**11**	**366**	**11**	**91**	**57**	**3**	**3050**	**4**	**291**	**1810**	**4400**	**621**
Typical - 1	**< 50%**	**395**	**18**	**11**	**366**	**11**	**91**	**57**	**3**	**3050**	**4**	**291**	**1810**	**4400**	**621**
* Frequency of detection		88%	36%	3%	88%	21%	0.3%	0.8%	10%	99%	24%	96%	100%	100%	92%

The average nationwide combined data is used as the basis for assigning the color-coded exposure classifications in the ***AIR PROFILE***™ Comparison Summary Charts provided with the EAA laboratory reports. The East Coast / Midwest data and the West Coast data provided below should be considered when a more concise regional data comparison is required. * Outside molds estimated by subtracting the Asp/Pen & WI fungi from the Total spores

EAST COAST/MIDWEST INDOOR PERCENTILE RANKING DATA

Classification	Percentile	Total	Asp/Pen	WI	* OS	HYP	Al/Fn	Insect	Pollen	SCF	FG	CE/SYN	OPA	MIN	Fire
Elevated - 6	**>99%**	**39555**	**25285**	**282**	**13988**	**576**	**1096**	**1652**	**27**	**19944**	**572**	**3409**	**28875**	**112000**	**37459**
Elevated - 5	**> 95%**	**13375**	**4520**	**116**	**8739**	**113**	**548**	**826**	**14**	**10900**	**58**	**1298**	**9506**	**28520**	**4780**
Atypical - 4	**> 90%**	**7200**	**1320**	**58**	**5822**	**57**	**274**	**341**	**7**	**8222**	**28**	**960**	**5908**	**15860**	**2518**
Atypical - 3	**> 75%**	**1920**	**169**	**29**	**1722**	**29**	**137**	**71**	**7**	**5080**	**14**	**549**	**3110**	**8000**	**993**
Typical - 2	**> 50%**	**452**	**18**	**15**	**419**	**11**	**91**	**57**	**7**	**2770**	**7**	**282**	**1590**	**4180**	**503**
Typical - 1	**< 50%**	**452**	**18**	**15**	**419**	**11**	**91**	**57**	**7**	**2770**	**7**	**282**	**1590**	**4180**	**503**
* Frequency of detection		90%	38%	4%	90%	20%	0.2%	0.7%	8%	98%	25%	95%	100%	100%	91%

* Outside molds estimated by subtracting the Asp/Pen & WI fungi from the Total spores

WEST COAST INDOOR PERCENTILE RANKING DATA

Classification	Percentile	Total	Asp/Pen	WI	* OS	HYP	Al/Fn	Insect	Pollen	SCF	FG	CE/SYN	OPA	MIN	Fire
Elevated - 6	**>99%**	**19124**	**9220**	**89**	**9815**	**576**	**902**	**488**	**40**	**43569**	**771**	**8835**	**75442**	**216830**	**105543**
Elevated - 5	**> 95%**	**6500**	**1293**	**61**	**5146**	**226**	**451**	**244**	**20**	**21485**	**114**	**3241**	**22650**	**78710**	**52772**
Atypical - 4	**> 90%**	**3550**	**456**	**30**	**3064**	**113**	**226**	**122**	**10**	**14880**	**50**	**1800**	**12200**	**36630**	**9893**
Atypical - 3	**> 75%**	**988**	**58**	**15**	**915**	**57**	**127**	**62**	**5**	**7530**	**25**	**819**	**5628**	**14400**	**2700**
Typical - 2	**> 50%**	**198**	**17**	**8**	**173**	**12**	**94**	**46**	**5**	**3715**	**12**	**373**	**2525**	**5190**	**1376**
Typical - 1	**< 50%**	**198**	**17**	**8**	**173**	**12**	**94**	**46**	**5**	**3715**	**12**	**373**	**2525**	**5190**	**1376**
* Frequency of detection		84%	31%	2%	84%	23%	0.8%	1.2%	13%	99%	22%	99%	100%	100%	95%

* Outside molds estimated by subtracting the Asp/Pen & WI fungi from the Total spores

Geometric extrapolation between percentile categories was used when an insufficient number of samples were collected to establish the 90th, 95th, and/or 99th percentiles, or when a significant number of measurements are *left-censored* (i.e. the concentrations are commonly found below the limit of detection). The categories where this approach has been applied include Water-indicating (W.I.) mold spores, Hyphal fragments, Algal and fern spores, Insect parts, Pollen, and Fiberglass fibers. Note: The fire residue data is known to be positively skewed as all of the samples were collected in suspect problem buildings.

Mold / bioaerosols - Asp/Pen = Aspergillus/Penicillium, WI = Water-indicating spores, OS = Outside/outdoor spores, HYP = Fungal Hyphal/mycelia fragments
Al/Fn = Algal & Fern spores, Insect = Insect parts, SCF = Skin Cell Fragments
Other Particles - FG = Fiberglass, CE/SYN = Cellulose/Synthetic fibers, OPA = Opaque/black particles, MIN = Mineral particles, Fire = Fire residue particles
** Frequency of Detection - Defined as the percentage of samples in each category that are measured above the detection limit.*

Regional Building Distribution	Total # of buildings	%
West / Coastal (W)	345	29%
Central / Midwest (C)	100	8%
East Coast / Northeast (EC)	765	63%
Total	1210	*(Indoor sampling only)*

Estimated Problem & Non-Problem Buildings		
Problem	87	7%
Non-problem	304	25%
Not determined	819	68%

Problem Building - Known "Complaint" area or mold exposure condition with 2 or more mold samples >90th percentile range.

Non-problem building - Known "Non-complaint" area or where the data set (consisting of 3 or more samples) are less than the 75thpercentile.

*A summary of the EAA statistical database analysis and **AIR PROFILE**™ exposure classification guidelines is available as a separate document.*

AIRBORNE MOLD AND DUST ANALYSIS

EAA Method # : DUST-A01

RAW COUNT DATA ONLY - Do not use for volumetric concentration comparisons

Client Name : IHR Boise
Client Project # : IHR 6600
EAA Project# : 20-1515
Description : Avemere
Date collected : 11/18/20
Sample received : 11/23/20
Analysis magnification : 500x

Client Sample#	Sample Description / Location	Raw / Extrapolated Count Comments
118a	Patient/shelf	*Note: When a fractional raw particle count is present, (e.g. 0.3), the count is based on counting the "entire sample" at low magnification.The results are then "back-calculated" to the high magnification detection limit for that specific particle category. This "raw" count page is required to be reported to the client as directed by the AIHA-LAP accreditation program.*
118b	Patient/shelf #2	
120a	Patient/shelf	
120b	Patient/shelf #2	
120y	Near supply unoccupied	

AIRBORNE MOLD / DUST (Raw / Extrapolated Spore Counts Only) - Spore Trap Sample Analysis

Category Sample # -->	118a	118b	120a	120b	120y
Total Mold Spores - Total Cts.	**2**	**7**	**9**	**2**	**3**
Alternaria		0.3			
Aspergillus/Penicillium		1			1
Pigmented Asco & Basidio		1	1		
Mix tiny, hyal Asco & Basidio	1	1	4	1	
Botrytis					
Chaetomium					
Cladosporium		1			1
Curvularia					
Drechslera/Bipolaris					
Epicoccum					
Fusicladium-like					
Nigrospora					
Oidium/Peronospora					
Pithomyces					
Rusts			0.3		
Smuts / Myxomycetes / Periconia	1	3	4	1	1
Stachybotrys					
Stemphylium					
Torula					
Ulocladium					
Other Hyaline Fungi					
Other Fungi					
Unidentified Fungi					
Hyphae fragments		1			
Algal / fern spores					
Insect parts					
POLLEN (Total cts)	**1**	**not detected**	**not detected**	**1**	**not detected**
Not specified	1			1	
Pinus					
COMMON AEROSOLS	**58**	**283**	**130**	**117**	**240**
Skin cell fragments	18	68	40	38	110
Fiberglass fibers					
Cellulosic / synthetic fibers	2	6	2	4	2
Unidentified opaque	14	134	46	35	37
Mineral / clay soil dust	24	75	42	40	91
OTHER PARTICLES	**not detected**	**not detected**	**not detected**	**not detected**	**not detected**

Statistical Parameters					
Vol. analyzed (m^3)-high mag - 500x:	0.022	0.022	0.022	0.022	0.022
Detect limit(Cts/m^3)-high magnification:	45.7	45.7	45.7	45.7	45.7
% sample analyzed-high magnification:	29%	29%	29%	29%	29%
Vol. analyzed(m^3)/entire sple 150-300x:	0.075	0.075	0.075	0.075	0.075
* Detection limit (Cts/m^3)/entire sple:	13.3	13.3	13.3	13.3	13.3
* Note: The "entire sample" detection limit applies to the "large" particle categories analyzed during the low magnification examination of the entire sample					
Sample flow rate (lpm):	15.0	15.0	15.0	15.0	15.0
Sample trace length (mm):	14.40	14.40	14.40	14.40	14.40
Microscope field diameter (mm):	0.420	0.420	0.420	0.420	0.420

***NOTE**: The raw particle count data cannot be used as a measure of the actual airborne concentration and only represents the number of "raw" or extrapolated particles counted.*

Where a fractional value is present (e.g. 0.3 or 1.3) for any mold or dust category, the entire trace for this category was analyzed and the "entire sample detection limit" applies.

Analyst : jrh
Date analyzed: 11/24/20

AIRBORNE MOLD AND DUST ANALYSIS

EAA Method # : DUST-A01

RAW COUNT DATA ONLY - Do not use for volumetric concentration comparisons

end of data report

Client Name : IHR Boise | Description : Avemere

Client Project # : IHR 6600 | Date collected : 11/18/20

EAA Project# : 20-1515 | Sample received : 11/23/20 | Analysis magnification : 500x

Client Sample#	Sample Description / Location	Raw / Extrapolated Count Comments
118y	**Near supply occupied**	*Note: When a fractional raw particle count is present, (e.g. 0.3), the count is based on counting the "entire sample" at low magnification.The results are then "back-calculated" to the high magnification detection limit for that specific particle category. This "raw" count page is required to be reported to the client as directed by the AIHA-LAP accreditation program.*

AIRBORNE MOLD / DUST (Raw / Extrapolated Spore Counts Only) - Spore Trap Sample Analysis

Category Sample # -->	118y
Total Mold Spores - Total Cts.	**1**
Alternaria	
Aspergillus/Penicillium	
Pigmented Asco & Basidio	
Mix tiny, hyal Asco & Basidio	1
Botrytis	
Chaetomium	
Cladosporium	
Curvularia	
Drechslera/Bipolaris	
Epicoccum	
Fusicladium-like	
Nigrospora	
Oidium/Peronospora	
Pithomyces	
Rusts	
Smuts / Myxomycetes / Periconia	
Stachybotrys	
Stemphylium	
Torula	
Ulocladium	
Other Hyaline Fungi	
Other Fungi	
Unidentified Fungi	
Hyphae fragments	
Algal / fern spores	
Insect parts	
POLLEN (Total cts)	**not detected**
Not specified	
Pinus / other	
COMMON AEROSOLS	**184**
Skin cell fragments	88
Fiberglass fibers	
Cellulosic / synthetic fibers	5
Unidentified opaque	48
Mineral / clay soil dust	43
OTHER PARTICLES	**not detected**

Statistical Parameters	
Vol. analyzed (m^3)-high mag - 500x:	0.022
Detect limit(Cts/m^3)-high magnification:	45.7
% sample analyzed-high magnification:	29%
Vol. analyzed(m^3)/entire sple 150-300x:	0.075
* Detection limit (Cts/m^3)/entire sple:	13.3

* Note: The "entire sample" detection limit applies to the "large" particle categories analyzed during the low magnification examination of the entire sample

Sample flow rate (lpm):	15.0
Sample trace length (mm):	14.40
Microscope field diameter (mm):	0.420

***NOTE**: The raw particle count data cannot be used as a measure of the actual airborne concentration and only represents the number of "raw" or extrapolated particles counted.*

Where a fractional value is present (e.g. 0.3 or 1.3) for any mold or dust category, the entire trace for this category was analyzed and the "entire sample detection limit" applies.

Analyst : jrh | Date analyzed: 11/24/20

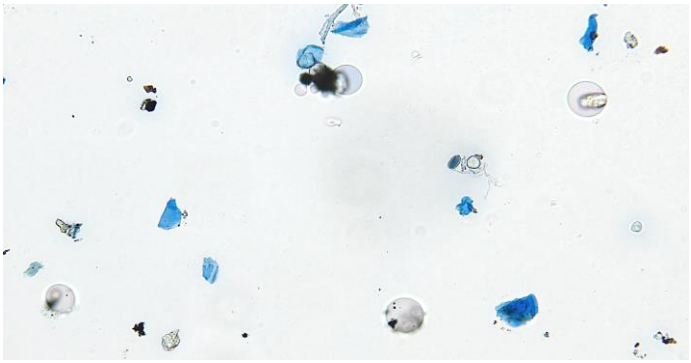
AIRBORNE MOLD AND DUST ANALYSIS

IHR Boise
IHR 6600
20-1515

Photo Report

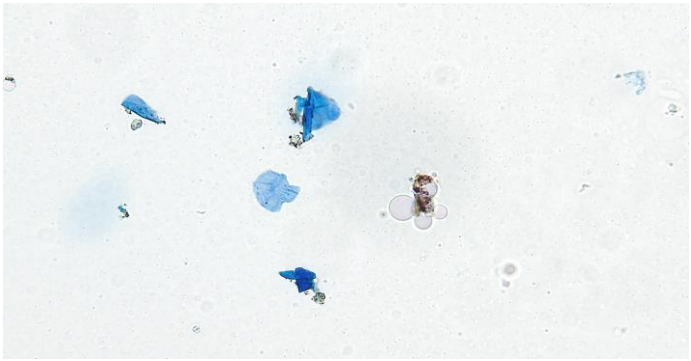
118a
Patient/shelf
200

118a
Patient/shelf
200

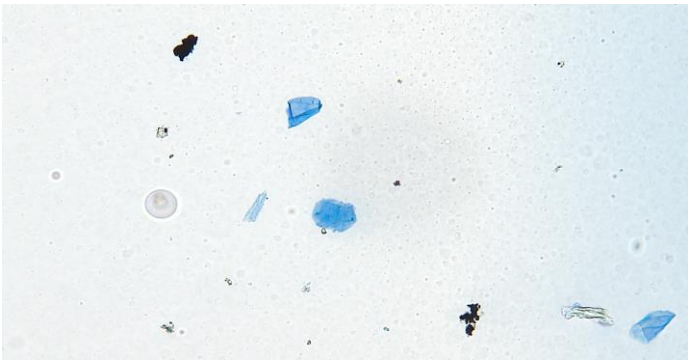


118b
Patient/shelf #2
200

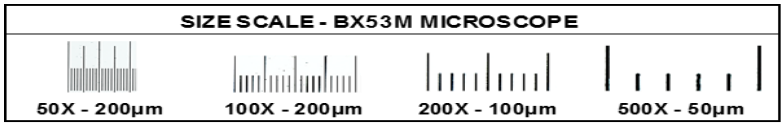
118b
Patient/shelf #2
200



120a
Patient/shelf
200



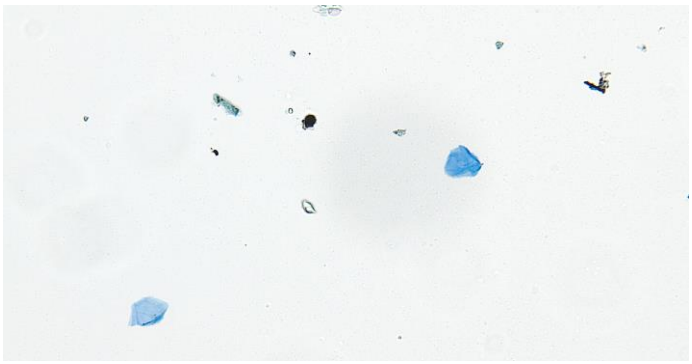
120a
Patient/shelf
200



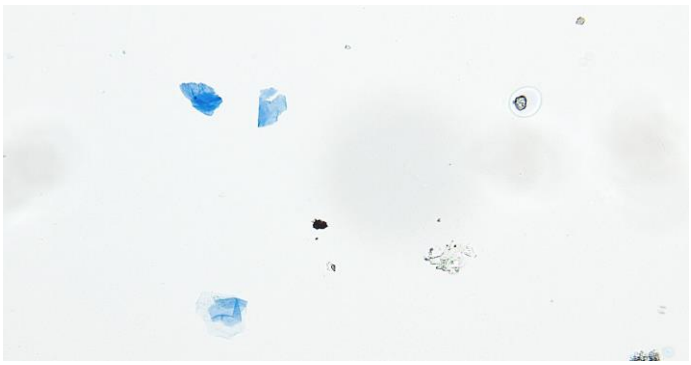
AIRBORNE MOLD AND DUST ANALYSIS

IHR Boise
IHR 6600
20-1515

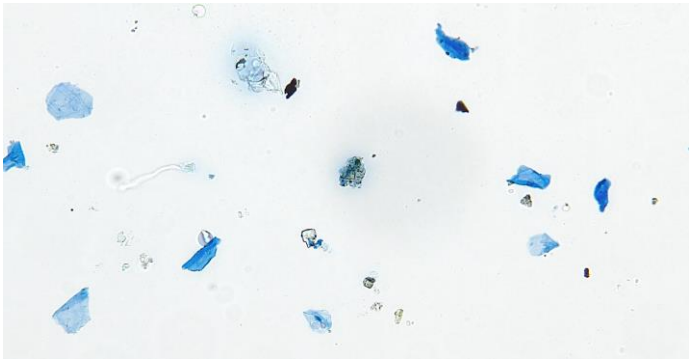
Photo Report



120b
Patient/shelf #2
200

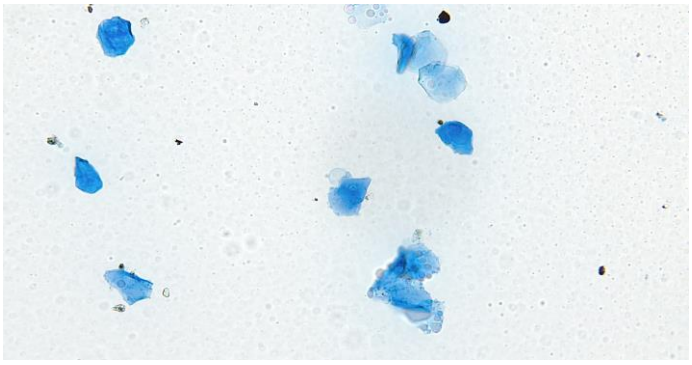


120b
Patient/shelf #2
200

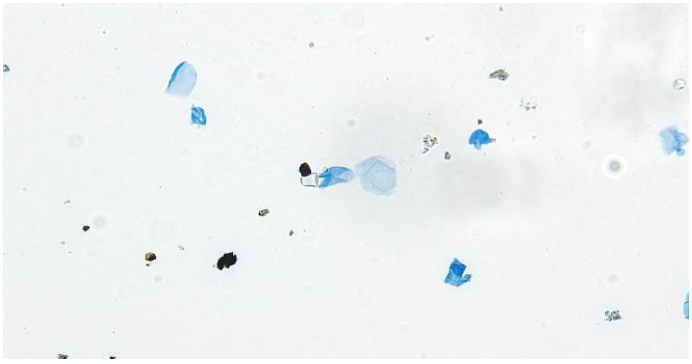


120y
Near supply unoccupied
200

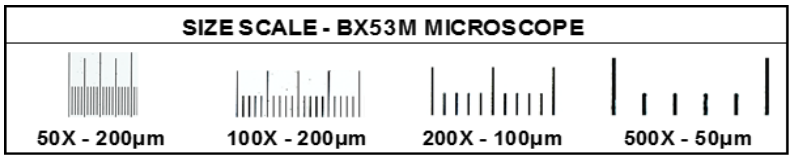
120y
Near supply unoccupied
200



118y
Near supply occupied
200



118y
Near supply occupied
200



Limitations/Disclaimer

The scope of the investigation described in this report has been limited by agreement of the parties based upon financial and other considerations. Further, the scope of this report is limited to the matters expressly covered herein. The investigation, testing and analysis of compounds and materials at the site have been limited to those compounds and materials set out in the parties' agreement. Other compounds or materials not tested for could be present at the site.

The investigation, testing and analysis described in this report has been undertaken and performed in a professional manner in accordance with generally accepted practices, using the degree of skill and care ordinarily exercised by a Diplomat of the American Board of Industrial Hygiene (ABIH); a "Certified Industrial Hygienist (CIH)".

During the investigation and in preparing this report we have relied upon information provided by third parties, including independent laboratories and testing services (with appropriate accreditations). It is believed that the information obtained from others during the investigation is reasonable. However, it is not warranted or guaranteed that the information provided by others is complete or accurate.

The investigation and this report are limited to the conditions present at the time of the site visits and inspections, and to the information available at the time this report was prepared. However, there is a distinct possibility that conditions, compounds or materials may exist which could not be identified within the agreed scope of this investigation or which were not apparent during site inspections or testing. Should any additional information become available, or should additional site work be undertaken, consultant should be notified so that we can determine if modification should be made to this report.

Where indicated or implied in this report, or where mandated by the condition of the site including its structure/improvements, the conclusions of this report are based on visual observations of the site. The conclusions of this report do not apply to any areas of the site not available for inspection or testing.

It should be recognized that the investigation and evaluation of environmental conditions is a science and an art. Judgments leading to conclusions and recommendations are at times made with an incomplete knowledge of all conditions applicable to the site. More detailed, focused and/or extensive studies can tend to reduce the inherent uncertainties associated with the evaluation of environmental conditions. No warranty, express or implied, is given.

This report is prepared for and intended for the exclusive use of the company, organization or individual to whom it is addressed. It may not be used or relied upon in any manner or for any purpose whatsoever by any other party without written authorization by IHR.