

Building Health Check Report

Report # 7214-26465

Prepared for:

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Facility:

**Hobomock Elementary (HES)
81 Learning Lane
Pembroke, MA 02359**

Jeri Praetsch
Accounts Payable
Pembroke County K-12
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Pembroke, MA 34112

**Re: Building Health Check Report # 7214-26465
Hobomock Elementary (HES)**

Dear Jeri Praetsch:

It is the privilege of Pure Air Control Services, Inc. ("Pure Air") to present for your review the results of the Building Health Check evaluation that was conducted on December 15, 2020 at the Hobomock Elementary (HES), 81 Learning Lane, Pembroke, MA.

We, at Pure Air, thank you for the opportunity to assist with your indoor air quality projects. Please do not hesitate to contact our office at 810-422-7873 should you have any questions regarding this report or if we can be of assistance in the future.

Respectfully Submitted,

PURE AIR CONTROL SERVICES, INC.

Donald Dufoe

Donald Dufoe,
Building Scientist

Enclosures





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INTRODUCTION

This report provides the detailed results of the Building Health Check (BHC) that was conducted at the request of Jeri Praetsch of Pembroke County K-12 on December 15, 2020 at the Hobomock Elementary (HES), 81 Learning Lane, Pembroke, MA.

BACKGROUND

The facility under this assessment encompasses approximately 81,433 ft² and was constructed in 1974. Structural framework and exterior siding materials consist of concrete block and red brick. Interior partitions are drywall over metal or wood framing. Flooring is comprised of vinyl floor tiles and carpet over a monolithic concrete slab. The roof consists of a flat frame covered with a vinyl membrane. The facility is comfort controlled by multiple Roof Top Units (RTUs) and associated air handlers. Pure Air was called completed this assessment and to ascertain baseline IAQ measurements and to provide current hygienic conditions within the structure. The results for such assessment are the subject of this report.

SCOPE OF WORK

The assays performed in this study included:

- Surface Tape Preparations to assess the distribution of fungal structures and/or other allergens settled on the environment.
- Radon Gas testing / analysis
- Surface sampling of frequently touched areas for COVID-19 and SARS-CoV-2
- Measurements of temperature and relative humidity for the assessment of comfort and conditions that might support microbial proliferation and chemical interactions.
- Measurements of carbon dioxide as a surrogate measure for ventilation adequacy.
- Particle counting of respirable size as an indicator of air filtration efficiency and/or unusual dust levels.
- The assessment also included a visual inspection of the air handler and the air distribution system to address any potential sanitary conditions that may need attention.



ENVIRONMENTAL SUMMARY REPORT

Environmental assays were performed in eight (8) representative zones within the Hobomock Elementary School. The areas tested include rooms 100, 125, 145, 160, 210, 225, 240, and 255. Pertinent outside air samples were collected for comparative and control purposes. The results derived from each assay were compared against the recommended guidelines to determine acceptability and are tabulated on the following pages.

Please note that figures highlighted in yellow (if any) contain values moderately outside the recommended levels, but the deviation raised no significant concerns and corrective actions are optional. Figures highlighted in red (if any) indicate with certainty that an abnormal condition exists, and remedial actions are highly recommended.

Air Quality

| Matrix | Parameter | Unit | Guideline* | Ref. | Room 160 | Room 145 | Room 100 | Room M125 | Room 255 | Room 240 | Room 225 | Room 210 | Outside Air |
|----------|-------------------|------|------------------|------|----------|----------|----------|-----------|----------|----------|----------|----------|-------------|
| Comfort | Temperature | °F | 72 to 78 | 1 | 66.6 | 68.8 | 70.8 | 68.4 | 72.7 | 73.2 | 72.9 | 72.9 | 33.0 |
| | Relative Humidity | % | 30 to 60 | 1 | 24.5 | 20.7 | 18.7 | 17.9 | 21.1 | 19.8 | 21.0 | 19.6 | 34.4 |
| Particle | Respirable size | p/l | 25,000 or 1/3 OA | 3 | 9,542 | 6,348 | 6,197 | 6,707 | 6,902 | 5,023 | 6,375 | 8,728 | 9,977 |

Foot Notes

| Units | Reference | Notes |
|--|---|--|
| cts/m³ = Counts per Cubic Meter of Air | 1. ASHRAE Handbook Fundamentals 2017 p10.16 | BDL = Below Detectable Limit |
| °F = Degrees Fahrenheit | 2. ASHRAE 62.1 - 2016 | OA = Outside Air |
| % = Percent | 3. Pure Air Control Services, Inc. | Red = Unacceptable, Remedial Action Highly Recommended |
| ppm= parts per million | 4. Molhave 1990 | Yellow = Marginal Condition. Remedial Actions Optional |
| p/l = particles per liter of air | 5 2016 ASHRAE Handbook – HVAC Systems and Equipment, Chapter 22.1 | NA = Not Applicable |
| | | * = See Guidelines Section |

Settled Aerosols in the Occupiable Space

| Matrix | Parameter | Unit | Guideline* | Ref. | Room 160 | | Room 145 | | Room 100 | | Room M125 | |
|-----------|---------------------|---------------------|------------|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | | | Teacher Desk | Student Desk | Teacher Desk | Student Desk | Teacher Desk | Student Desk | Teacher Desk | Student Desk |
| Tape Prep | Opaque Particles | cts/cm ² | 6000 | 3 | 1,970 | 2,700 | 578 | 248 | 973 | 950 | 1,660 | 3,930 |
| | Skin Cell Fragments | cts/cm ² | 1200 | 3 | 850 | 288 | 20 | 12 | 769 | 156 | 532 | 328 |
| | Insect Biodetritus | cts/cm ² | 32 | 3 | 16 | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| | Fibers | cts/cm ² | 240 | 3 | 488 | 572 | 16 | 4 | 468 | 24 | 292 | 56 |
| | Fiberglass Fibers | cts/cm ² | 32 | 3 | 8 | 4 | BDL | BDL | BDL | BDL | BDL | BDL |
| | Pollen | cts/cm ² | 32 | 3 | 12 | 44 | BDL | BDL | 4 | BDL | BDL | BDL |
| | Fungal Elements | cts/cm ² | 100 | 3 | 96 | 8 | BDL | BDL | 28 | BDL | 32 | 4 |
| | Other | cts/cm ² | 1300 | 3 | 1,490 | 1,900 | 256 | 64 | 623 | 236 | 644 | 729 |

Foot Notes

| Units | Reference | Notes |
|---|------------------------------------|--|
| cts/m ² = Counts per Square Centimeter | 3. Pure Air Control Services, Inc. | BDL = Below Detectable Limit NA = Not Applicable Red = Unacceptable, Remedial Actions Highly Recommended Yellow = Marginal Condition. Remedial Actions Optional * = See Guidelines Section |

Settled Aerosols in the Occupiable Space

| Matrix | Parameter | Unit | Guideline* | Ref. | Room 240 | | Room 225 | | Room 210 | | Room 255 | |
|-----------|---------------------|---------------------|------------|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | | | | Teacher Desk | Student Desk | Teacher Desk | Student Desk | Teacher Desk | Student Desk | Teacher Desk | Student Desk |
| Tape Prep | Opaque Particles | cts/cm ² | 6000 | 3 | 2,100 | 6,850 | 693 | 2,400 | 3,100 | 1,100 | 547 | 743 |
| | Skin Cell Fragments | cts/cm ² | 1200 | 3 | 332 | 172 | 292 | 132 | 288 | 36 | 216 | 72 |
| | Insect Biodetritus | cts/cm ² | 32 | 3 | BDL | BDL | BDL | BDL | BDL | BDL | BDL | 8 |
| | Fibers | cts/cm ² | 240 | 3 | 148 | 44 | 92 | 44 | 100 | 28 | 284 | 76 |
| | Fiberglass Fibers | cts/cm ² | 32 | 3 | BDL | BDL | BDL | 8 | BDL | BDL | BDL | BDL |
| | Pollen | cts/cm ² | 32 | 3 | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| | Fungal Elements | cts/cm ² | 100 | 3 | 144 | 12 | 4 | BDL | 4 | 4 | BDL | BDL |
| | Other | cts/cm ² | 1300 | 3 | 584 | 1,070 | 696 | 348 | 372 | 200 | 312 | 132 |

Foot Notes

| Units | Reference | Notes |
|---|------------------------------------|--|
| cts/m ² = Counts per Square Centimeter | 3. Pure Air Control Services, Inc. | BDL = Below Detectable Limit NA = Not Applicable Red = Unacceptable, Remedial Actions Highly Recommended Yellow = Marginal Condition. Remedial Actions Optional * = See Guidelines Section |



CONCLUSIONS

Based on the results derived from the environmental samples collected, and the observations, made at the time of the evaluation, no impending health concerns were raised. However, remedial actions are recommended to resolve some issues discussed below and improve on the quality of the indoor air.

Surface tape preparations were collected to assess the settled distribution of fungal structures and other allergens. The analytical results for the surface tape preparations collected from all eight (8) representative zones revealed fungal structure concentrations well within the recommended guideline except for room 240. Fungal elements were detected at a concentration of 144 counts per square centimeters (cts/m²), slightly above the recommended guidelines of 100 cts/m².

Surface tape preparations also provided insight into the composition and concentration of settled dust. The results revealed excessive dust settlement within Room 160, 100, M125, 255 (fibers), and room 240 (opaque particles). Black, Reddish-brown, and Talc-like particulates are considered as "Other" particles were exceeded in room 160 at a concentration of cts/m², above the guidance concentration of 1300 cts/m². Elevated dust settlement levels often time the result of elevated human activity and/or an indication for the need of increased housekeeping and air filtration efficiency also.

Dust particles whose overall diameter ranges from 0.3 to 5.0 microns are recognized as respirable-size particles. Respirable-size particles are generated by a broad variety of processes and activities and there are increasingly more studies linking associations between the concentrations of particles and health effects. In this case, the respirable-size particle concentrations detected in all the zones evaluated were well within the recommended levels, which raised no concerns at this time.

The ventilation requirement for most buildings is supplied by the HVAC system and/or by infiltration of the outside air. Carbon dioxide (CO₂) concentrations are used as surrogate measure to roughly assess the adequacy of the ventilation system. The results for the CO₂ measurements made at the time of the field evaluation were well within the recommended guideline. No concerns were raised by this assay method.

Temperature and relative humidity measurements of the ambient air were used to assess comfort, as well as an environmental factor that may increase the prevalence of indoor air quality problems (e.g., microbial activity, indoor allergens, viral infections, allergic rhinitis, asthma, ozone production, odors, etc.). In this assessment, the comfort in all areas test fell outside the recommended comfort envelope except for rooms 160, 145, and M125 as these temperatures were measured below the recommended range. However, based on the comparison of the outdoor temperature recorded at the time of the study (34.5° F), these low readings are not considered to be an environmental concern at this time.

Air handlers and duct systems that contain excessive dust, debris, and moisture are places where bacteria and fungi may proliferate and release odors and potentially other contaminants into the air stream. In this case, three air handler units were assessed, AHU-1, ACU-1, and AHU-7. All three units were observed with a significant layer of dust and fouling. It is highly recommended that the air handlers and associated ductwork be environmentally cleaned.



In addition to the IAQ assessment, a limited radon study was also completed within rooms 100, 125, 145, 160, 210, 225, 240, and 255. Radon is a colorless, odorless, tasteless, and radioactive gas that originates from the ground and is formed through a naturally occurring process of radioactive decay from Uranium containing elements found within the earth. The EPA recommends that radon levels should not exceed 4 pCi/L (Picocuries Per Litter) when tested.

Short term radon test kits known as Liquid Scintillation (LS) Devices, were provided to Pure Air Control Services by Accustar Laboratories. The LS device is initiated by removing the cap to allow for potentially radon-laden air to diffuse into the charcoal packet where the radon is adsorbed. The vials are to remain open and in place for a minimum of 48 hours. Once the minimum time for testing was achieved the containers were capped and sent back to Accustar Laboratories for analysis. Based on the results of the radon analysis, none of the locations tested were found to contain radon above the 4 pCi/L guidance concentration level. Please note that this testing was completed at the request of the Pembroke School System K-12 as a cursory test and was not meant to satisfy Federal EPA or State radon regulations.

RECOMMENDATIONS

The following recommendations were designed to resolve issues described in this report. No prioritization was implied by this listing; however, it was anticipated all items discussed would be addressed.

Air Conveyance

- ❖ Environmentally clean and sanitize the air handlers. The evaporator coils and blowers need to be thoroughly washed and then sanitized employing a combination of superheated steam at 300 °F and high flow-low pressure rinsing protocols. The use of chlorine-based chemicals, as well as self-rinsing techniques is highly discouraged. The sheet-metal cabinet walls within the air handler need to be cleaned using direct contact vacuum cleaners and soft brush attachments and then wiped with a towel moistened with a biocide registered with the EPA. After removing all the dust within the air handler, any existing interior fiberglass surfaces will need to be coated with an encapsulant such as Fiberlock 8100 or equivalent. Any existing insulation impacted with moisture, physical damage, or microbial growth at unmanageable levels will need to be replaced with new materials having the same or higher insulation values per inch, flame spread of not over 25 and smoke development rate of not over 50. The utilization of a closed cell liner such as IMCOA is highly recommended for the air handler and coil cabinets.
- ❖ Environmentally clean and sanitize the air distribution system using direct contact vacuum cleaners and soft brush attachments, agitating brushes, negative air machines, air brushes and other industry specialized equipment. After removing all the dust within the ductwork, any existing interior fiberglass surfaces will need to be coated with an encapsulant such as Fiberlock 8100 or equivalent. Any existing insulation impacted with moisture, physical damage, or microbial growth at unmanageable levels will need to be replaced with new



materials having the same or higher insulation values per inch, flame spread of not over 25 and smoke development rate of not over 50.

- ❖ Cleaning of the air conveyance system (air handlers and/or ductwork) needs to be completed by a qualified and licensed air-conditioning contractor who specializes on remediation and cleaning mold under proper containment, personal protection and health and safety protocols along with following industry accepted guidelines, e.g. National Air Duct Cleaning Association (NADCA) ACR Standard, *Assessment, Cleaning, and Restoration of HVAC Systems*, IICRC Reference Guide for professional Mold Remediation (IICRC S520) etc. It is recommended that a Certified Indoor Environmental Consultant be hired to monitor the air conveyance cleaning process and to provide cleanliness verification and clearance.

Environmental Cleaning

- ❖ It is recommended that rooms 100, M125, 160, 240, and 255 be “environmentally cleaned”. This entails cleaning and sanitizing all surfaces e.g., walls, ceilings, flooring, cabinets, doors, windows, blinds, counter tops, open shelving, smooth and hard surface furniture, etc. utilizing direct contact vacuuming with soft brushes and then wiped with a cloth dampened with a biocide registered with the EPA. In order to ensure a more complete and thorough penetration of the biocide especially in soft surfaces and hard to reach crevasses it is recommended that the environment be atomized with a disinfectant system such as Halosil or equivalent.

General

- ❖ To ensure adequate air filtration including mold spores as well as particulate matter of 3 microns and larger, ensure that the Minimum Efficiency Reporting Value (MERV) of the air filters is at least 8. The filtration surface should be large enough to operate the air conditioner within the manufacturer’s recommended static pressure range.
- ❖ To avoid hygiene degradation of the air conveyance system and excessive use of energy, ensure that the filters fit snugly in their racks, the filter covers fit properly, the air handler penetrations (e.g., chilled water lines and condensate fittings, electric conduit, etc.) are properly sealed and the gaskets and fasteners for the service panels are in good order. Air-conditioning maintenance should incorporate procedures to regularly (e.g. twice a year) maintain the air handlers and ductwork hygienically clean (free from visible dust and mold) and in good working order.
- ❖ Set the thermostats (and any other relevant controls) to maintain the temperature and relative humidity within the recommended levels. The ASHRAE 2017 Book of Fundamentals suggests a comfort range of 72 to 78 °F for healthy living conditions. For indoor air quality purposes, the relative humidity should be maintained within the optimum range of 30 and 60% (as suggested in the 2016 ASHRAE Handbook – HVAC Systems and Equipment, Chapter 22, Page 1).
- ❖ Ensure that housekeeping employs vacuum cleaners in good working order and equipped with high efficiency particle arrestance filtration for cleaning all flooring routinely and thoroughly.



PHOTOGRAPHS

AHU-1



1) AHU-1 under assessment.



2) Return plenum with considerable fouling.



3) Air filters in marginal sanitary condition.



4) Secondary filters with considerable fouling.

AHU-1



5) Cooling coils with considerable fouling.



6) Blower housing with considerable fouling.



7) Blower wheel in marginal sanitary condition.



8) Supply air duct in marginal sanitary condition.

ACU-1



9) ACU-1 under assessment.



10) Return air plenum and air filters in overall acceptable sanitary condition.



11) Secondary air filter in overall acceptable sanitary condition.



12) Cooling coil in overall acceptable sanitary condition.

ACU-1



13) Blower housing with considerable fouling.



14) Blower wheel with considerable fouling.



15) Supply air plenum in good sanitary condition.



16) Supply air grille with considerable fouling.

AHU-7



17) AHU-7 under assessment.



18) Return plenum with considerable fouling and deteriorated O/A filtration.



19) Primary air filters in acceptable sanitary condition.



20) Secondary air filters in good sanitary condition.

AHU-7



21) Downstream side of cooling coil in good sanitary condition.



22) Blower wheel within considerable fouling.



23) Blower wheel with considerable fouling.

INTENTIONALLY LEFT BLANK

24)



LABORATORY RESULTS

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 160**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192067**
 Field Sample# : **2**
 Sample Date: **12/15/2020**
 Sample Time: **9:12 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59976**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 118 | 1,970 | 40.0 % |
| Skin Cell Fragments | 102 | 850 | 17.3 % |
| Insect Biodetritus | 4 | 16 | 0.325 % |
| Total Fibers | 122 | 488 | 9.92 % |
| Fiberglass Fibers | 2 | 8 | 0.163 % |
| Hair, Animal | 1 | 4 | 0.0813 % |
| Plant Fibers | 1 | 4 | 0.0813 % |
| Man-made Fibers | 118 | 472 | 9.59 % |
| Total Pollen | 3 | 12 | 0.244 % |
| Pinaceae (Pine) Species | 1 | 4 | 0.0813 % |
| Pollen Grains | 2 | 8 | 0.163 % |
| Total Fungal Elements/Spores | 24 | 96 | 1.95 % |
| Pithomyces species | 1 | 4 | 0.0813 % |
| Periconia species | 3 | 12 | 0.244 % |
| Rust spores | 4 | 16 | 0.325 % |
| Dematiaceous Fungal Hyphal Elements | 6 | 24 | 0.488 % |
| Dematiaceous Fungal Spore Elements | 10 | 40 | 0.813 % |
| Total "Other" | 149 | 1,490 | 30.3 % |
| Bird Feathers | 3 | 12 | 0.24 % |
| "Talc-Like" Particles | 5 | 20 | 0.41 % |
| Black Particles | 36 | 144 | 2.93 % |
| Reddish-Brown Particles | 105 | 1,310 | 26.63 % |
| Total Counts: | 522 | 4,920 | 100.0 % |

Method of Analysis: EDLAB SOP-7/13001

BDL = Below Detection Limit: No particles were reported from the microscopically observed area on the specimen slide (at 10x10 or 10x40 magnification).

The results in this report apply only to the sample(s) specifically listed above and tested at Environmental Diagnostics Laboratory. Unless otherwise noted, samples were received in good condition. Laboratory-prepared Quality Control (QC) samples are analyzed with the samples routinely; however, unless a blank (control) is received, the result for the control is not compared. Quantitative data is based on 3 significant figures; Grand Total may not equal 100% due to rounding.

Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 160**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192068**
 Field Sample# : **3**
 Sample Date: **12/15/2020**
 Sample Time: **9:12 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59977**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 108 | 2,700 | 49.0 % |
| Skin Cell Fragments | 72 | 288 | 5.23 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 143 | 572 | 10.4 % |
| Fiberglass Fibers | 1 | 4 | 0.0726 % |
| Hair, Animal | 1 | 4 | 0.0726 % |
| Plant Fibers | 1 | 4 | 0.0726 % |
| Man-made Fibers | 140 | 560 | 10.2 % |
| Total Pollen | 11 | 44 | 0.799 % |
| Pinaceae (Pine) Species | 11 | 44 | 0.799 % |
| Total Fungal Elements/Spores | 2 | 8 | 0.145 % |
| Dematiaceous Fungal Hyphal Elements | 1 | 4 | 0.0726 % |
| Dematiaceous Fungal Spore Elements | 1 | 4 | 0.0726 % |
| Total "Other" | 209 | 1,900 | 34.5 % |
| Bird Feathers | 1 | 4 | 0.07 % |
| Black Particles | 103 | 936 | 16.99 % |
| Reddish-Brown Particles | 105 | 955 | 17.33 % |
| Total Counts: | 545 | 5,510 | 100.0 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 145**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192070**
 Field Sample# : **5**
 Sample Date: **12/15/2020**
 Sample Time: **9:12 AM**


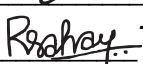
Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59978**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticles | 104 | 578 | 66.4 % |
| Skin Cell Fragments | 5 | 20 | 2.30 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 4 | 16 | 1.84 % |
| Man-made Fibers | 4 | 16 | 1.84 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | BDL | BDL | N/A |
| Total "Other" | 64 | 256 | 29.4 % |
| Black Particles | 14 | 56 | 6.44 % |
| Reddish-Brown Particles | 50 | 200 | 22.99 % |
| Total Counts: | 177 | 870 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 145**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192071**
 Field Sample# : **6**
 Sample Date: **12/15/2020**
 Sample Time: **9:12 AM**


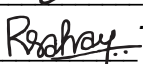
Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59979**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 62 | 248 | 75.6 % |
| Skin Cell Fragments | 3 | 12 | 3.66 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 1 | 4 | 1.22 % |
| Man-made Fibers | 1 | 4 | 1.22 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | BDL | BDL | N/A |
| Total "Other" | 16 | 64 | 19.5 % |
| Reddish-Brown Particles | 16 | 64 | 19.51 % |
| Total Counts: | 82 | 328 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

BDL = Below Detection Limit: No particles were reported from the microscopically observed area on the specimen slide (at 10x10 or 10x40 magnification).

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 100**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192073**
 Field Sample# : **8**
 Sample Date: **12/15/2020**
 Sample Time: **9:20 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59980**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 107 | 973 | 33.9 % |
| Skin Cell Fragments | 100 | 769 | 26.8 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 117 | 468 | 16.3 % |
| Plant Fibers | 1 | 4 | 0.139 % |
| Man-made Fibers | 116 | 464 | 16.2 % |
| Total Pollen | 1 | 4 | 0.139 % |
| Pinaceae (Pine) Species | 1 | 4 | 0.139 % |
| Total Fungal Elements/Spores | 7 | 28 | 0.976 % |
| Pithomyces species | 1 | 4 | 0.139 % |
| Dematiaceous Fungal Spore Elements | 6 | 24 | 0.836 % |
| Total "Other" | 130 | 623 | 21.7 % |
| "Talc-Like" Particles | 9 | 36 | 1.25 % |
| Black Particles | 18 | 72 | 2.51 % |
| Reddish-Brown Particles | 103 | 515 | 17.94 % |
| Total Counts: | 462 | 2,870 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 100**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192074**
 Field Sample# : **9**
 Sample Date: **12/15/2020**
 Sample Time: **9:20 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59981**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticles | 114 | 950 | 69.3 % |
| Skin Cell Fragments | 39 | 156 | 11.4 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 6 | 24 | 1.75 % |
| Man-made Fibers | 6 | 24 | 1.75 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | BDL | BDL | N/A |
| Total "Other" | 59 | 236 | 17.2 % |
| "Talc-Like" Particles | 1 | 4 | 0.29 % |
| Black Particles | 3 | 12 | 0.88 % |
| Reddish-Brown Particles | 55 | 220 | 16.06 % |
| Total Counts: | 218 | 1,370 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm M125**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192076**
 Field Sample# : **11**
 Sample Date: **12/15/2020**
 Sample Time: **9:26 AM**


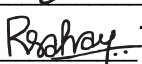
Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59982**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 116 | 1,660 | 52.5 % |
| Skin Cell Fragments | 101 | 532 | 16.8 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 73 | 292 | 9.24 % |
| Man-made Fibers | 73 | 292 | 9.24 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 8 | 32 | 1.01 % |
| Dematiaceous Fungal Hyphal Elements | 1 | 4 | 0.127 % |
| Cladosporium species | 1 | 4 | 0.127 % |
| Dematiaceous Fungal Spore Elements | 6 | 24 | 0.759 % |
| Total "Other" | 121 | 644 | 20.4 % |
| Bird Feathers | 1 | 4 | 0.13 % |
| "Talc-Like" Particles | 2 | 8 | 0.25 % |
| Black Particles | 15 | 60 | 1.90 % |
| Reddish-Brown Particles | 103 | 572 | 18.10 % |
| Total Counts: | 419 | 3,160 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm M125**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192077**
 Field Sample# : **12**
 Sample Date: **12/15/2020**
 Sample Time: **9:26 AM**


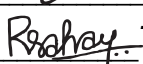
Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59983**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 118 | 3,930 | 77.8 % |
| Skin Cell Fragments | 82 | 328 | 6.50 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 14 | 56 | 1.11 % |
| Hair, Animal | 1 | 4 | 0.0792 % |
| Man-made Fibers | 13 | 52 | 1.03 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 1 | 4 | 0.0792 % |
| Dematiaceous Fungal Spore Elements | 1 | 4 | 0.0792 % |
| Total "Other" | 115 | 729 | 14.4 % |
| Black Particles | 14 | 56 | 1.11 % |
| Reddish-Brown Particles | 101 | 673 | 13.33 % |
| Total Counts: | 330 | 5,050 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 255**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192079**
 Field Sample# : **14**
 Sample Date: **12/15/2020**
 Sample Time: **9:31 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59984**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticles | 104 | 547 | 40.2 % |
| Skin Cell Fragments | 54 | 216 | 15.9 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 71 | 284 | 20.9 % |
| Man-made Fibers | 71 | 284 | 20.9 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | BDL | BDL | N/A |
| Total "Other" | 78 | 312 | 22.9 % |
| "Talc-Like" Particles | 4 | 16 | 1.18 % |
| Black Particles | 4 | 16 | 1.18 % |
| Reddish-Brown Particles | 70 | 280 | 20.59 % |
| Total Counts: | 307 | 1,360 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 255**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192080**
 Field Sample# : **15**
 Sample Date: **12/15/2020**
 Sample Time: **9:31 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59985**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 104 | 743 | 72.1 % |
| Skin Cell Fragments | 18 | 72 | 6.99 % |
| Insect Biodetritus | 2 | 8 | 0.777 % |
| Total Fibers | 19 | 76 | 7.38 % |
| Man-made Fibers | 19 | 76 | 7.38 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | BDL | BDL | N/A |
| Total "Other" | 33 | 132 | 12.8 % |
| "Talc-Like" Particles | 1 | 4 | 0.39 % |
| Reddish-Brown Particles | 32 | 128 | 12.43 % |
| Total Counts: | 176 | 1,030 | 99.9 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 240**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192082**
 Field Sample# : **17**
 Sample Date: **12/15/2020**
 Sample Time: **9:36 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59986**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticles | 147 | 2,100 | 63.4 % |
| Skin Cell Fragments | 83 | 332 | 10.0 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 37 | 148 | 4.47 % |
| Plant Fibers | 1 | 4 | 0.121 % |
| Man-made Fibers | 36 | 144 | 4.35 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 36 | 144 | 4.35 % |
| Fungal Spore Elements | 36 | 144 | 4.35 % |
| Total "Other" | 120 | 584 | 17.6 % |
| "Talc-Like" Particles | 1 | 4 | 0.12 % |
| Black Particles | 15 | 60 | 1.81 % |
| Reddish-Brown Particles | 104 | 520 | 15.71 % |
| Total Counts: | 423 | 3,310 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 240**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192083**
 Field Sample# : **18**
 Sample Date: **12/15/2020**
 Sample Time: **9:36 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59987**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticles | 137 | 6,850 | 84.0 % |
| Skin Cell Fragments | 43 | 172 | 2.11 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 11 | 44 | 0.540 % |
| Man-made Fibers | 11 | 44 | 0.540 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 3 | 12 | 0.147 % |
| Dematiaceous Fungal Hyphal Elements | 1 | 4 | 0.0491 % |
| Dematiaceous Fungal Spore Elements | 1 | 4 | 0.0491 % |
| Fungal Spore Elements | 1 | 4 | 0.0491 % |
| Total "Other" | 134 | 1,070 | 13.1 % |
| Black Particles | 29 | 116 | 1.42 % |
| Reddish-Brown Particles | 105 | 955 | 11.72 % |
| Total Counts: | 328 | 8,150 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 225**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192085**
 Field Sample# : **20**
 Sample Date: **12/15/2020**
 Sample Time: **9:41 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59988**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 104 | 693 | 38.9 % |
| Skin Cell Fragments | 73 | 292 | 16.4 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 23 | 92 | 5.17 % |
| Man-made Fibers | 23 | 92 | 5.17 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 1 | 4 | 0.225 % |
| Dematiaceous Fungal Spore Elements | 1 | 4 | 0.225 % |
| Total "Other" | 134 | 696 | 39.1 % |
| "Talc-Like" Particles | 2 | 8 | 0.45 % |
| Black Particles | 29 | 116 | 6.52 % |
| Reddish-Brown Particles | 103 | 572 | 32.13 % |
| Total Counts: | 335 | 1,780 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 225**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192086**
 Field Sample# : **21**
 Sample Date: **12/15/2020**
 Sample Time: **9:41 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **59989**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 120 | 2,400 | 82.2 % |
| Skin Cell Fragments | 33 | 132 | 4.52 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 11 | 44 | 1.51 % |
| Fiberglass Fibers | 2 | 8 | 0.274 % |
| Man-made Fibers | 9 | 36 | 1.23 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | BDL | BDL | N/A |
| Total "Other" | 87 | 348 | 11.9 % |
| Black Particles | 2 | 8 | 0.27 % |
| Reddish-Brown Particles | 85 | 340 | 11.64 % |
| Total Counts: | 251 | 2,920 | 99.9 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 210**
 Test Site : **Top of Teacher's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192088**
 Field Sample# : **23**
 Sample Date: **12/15/2020**
 Sample Time: **9:46 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **60008**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 124 | 3,100 | 80.3 % |
| Skin Cell Fragments | 72 | 288 | 7.46 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 25 | 100 | 2.59 % |
| Man-made Fibers | 25 | 100 | 2.59 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 1 | 4 | 0.104 % |
| Dematiaceous Fungal Spore Elements | 1 | 4 | 0.104 % |
| Total "Other" | 93 | 372 | 9.64 % |
| "Talc-Like" Particles | 1 | 4 | 0.10 % |
| Reddish-Brown Particles | 92 | 368 | 9.53 % |
| Total Counts: | 315 | 3,860 | 99.9 % |

Method of Analysis: EDLAB SOP-7/13001

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Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report

Surface Microscopy

Tape Prep Assay

Client : **Pembroke County K-12**
 Jobsite : **Hobomock Elementary School (HES)**
 Location : **Hobomock ES**

PACS ID# : **07214**
 Work Order # : **026465**
 Project Date : **12/15/2020**

Unit : **N/A**
 Zone : **Rm 210**
 Test Site : **Top of Student's Desk**
 Diagnostic Tech : **LAB**
 Sample Type: **TapePrep Assay**

Lab Sample# : **192089**
 Field Sample# : **24**
 Sample Date: **12/15/2020**
 Sample Time: **9:46 AM**



Date Lab. Rec'd. : **12/23/2020**
 Date Analyzed: **12/24/2020**
 Date Issued : **12/28/20**
 Sample Serial #: **60009**

| <u>Particle Identification</u> | <u>Raw Count</u> | <u>Total Count (Cts/cm²)</u> | <u>Percent of Total Count</u> |
|-------------------------------------|------------------|---|-------------------------------|
| OpaqueParticiles | 110 | 1,100 | 80.3 % |
| Skin Cell Fragments | 9 | 36 | 2.63 % |
| Insect Biodetritus | BDL | BDL | N/A |
| Total Fibers | 7 | 28 | 2.04 % |
| Man-made Fibers | 7 | 28 | 2.04 % |
| Total Pollen | BDL | BDL | N/A |
| Total Fungal Elements/Spores | 1 | 4 | 0.292 % |
| Dematiaceous Fungal Spore Elements | 1 | 4 | 0.292 % |
| Total "Other" | 50 | 200 | 14.6 % |
| Black Particles | 7 | 28 | 2.04 % |
| Reddish-Brown Particles | 43 | 172 | 12.55 % |
| Total Counts: | 177 | 1,370 | 100 % |

Method of Analysis: EDLAB SOP-7/13001

BDL = Below Detection Limit: No particles were reported from the microscopically observed area on the specimen slide (at 10x10 or 10x40 magnification).

The results in this report apply only to the sample(s) specifically listed above and tested at Environmental Diagnostics Laboratory. Unless otherwise noted, samples were received in good condition. Laboratory-prepared Quality Control (QC) samples are analyzed with the samples routinely; however, unless a blank (control) is received, the result for the control is not compared. Quantitative data is based on 3 significant figures; Grand Total may not equal 100% due to rounding.

Quality Controlled By : 
 Approved By : 
Rajiv R. Sahay, Ph.D.

Opaque Particles Identified from Tape Prep Assays

Client : **Pembroke County K-12**
Jobsite : **Hobomock Elementary School (HES)**

PACS ID# : **07214**
Work Order # : **026465**

Opaque Particles

These particles may originate from inorganic or organic sources in nature. However, it appears opaque when observed under light microscopy. It has various shape and sizes. It may be regular or irregular in shape. On an average it can be measured less than one micron to well over fifty microns with some exceptions. Commonly these particles include but are not limited to dust & debris, paint, combustions, emission, ash, silica and others.

These particulates are significant from a health/allergy point of view especially in case of respiratory disorder.

Fibers Identified from Tape Prep Assays

Client : **Pembroke County K-12**
Jobsite : **Hobomock Elementary School (HES)**

PACS ID# : **07214**
Work Order # : **026465**

Fiberglass Fibers

Fiberglass is a material made from extremely fine fibers of glass. In indoor environments, it is used as an insulating material for HVAC systems. It appears as a smooth-walled, elongated, tube-like structure under the microscope with varying size ranges (avg. range 1-micron to over 1000-microns).

It is listed as an irritant.

Hair, Animal

Plant Fibers

Technically, Plant fibers are known as Plant Trichomes. A Plant Trichome is the hairy out growth from the aerial part of the plant. Not all plants can produce plant trichomes. Plant trichomes vary greatly in their size and shape. On an average, these structures measure from a few microns to well over a few millimeters. It may be a simple unicellular elongated structure or a complex multi-cellular structure. Sometimes also filled with various biochemicals.

Plant trichomes are significant from an allergenic/disease point of view especially eczema and other dermal allergies.

Man-made Fibers

Man-made fibers may come from natural raw materials like cellulose or from synthetic chemicals like rayon, nylon, etc. In indoor environments, some important sources of man made fiber include carpet, cellulose based building materials, clothing, paper and paper products, etc. Size of these fibers varies from a few microns to a several centimeters; however, an average size range may be 1 micron to over 500 microns.

Health implications of these particles are not well described, however some of the man-made fibers are important from an allergy point of view especially for dermal allergy.

Pollen Species Identified from Tape Prep Assays

Client : **Pembroke County K-12**
Jobsite : **Hobomock Elementary School (HES)**

PACS ID# : **07214**
Work Order # : **026465**

Pinaceae (Pine) Species

There are six genera of evergreens that are found primarily in North America: fir (*Abies*); larch, tamarack (*Larix*); spruce (*Picea*); pine (*Pinus*); Douglas fir (*Pseudotsuga*); and hemlock (*Tsuga*). Abundant pollen is produced in the spring and early summer. The large pollen have air bladders which permit them to travel great distances. Rarely does it cause pollinosis [an allergic reaction (hay fever) resulting in a type I antibody-mediated hypersensitivity].

Pollen Grains

Pollen grains are the male reproductive unit of flowering plant usually produced by anthers. They are microscopic particles of various shape (mostly spheroidal or ellipsoidal), sizes (5 micron to more than 200 micron). Pollen grains may also have furrows or pore or both on their surface that helps in their identification.

They can be air-borne and remain in the ambient air depending upon their buoyancy. They may be carried some distance from the immediate vicinity of the parent. Some pollen grains are allergenic in nature.

Spores / Fungal Elements Identified from Tape Prep Assays

Client : **Pembroke County K-12**
Jobsite : **Hobomock Elementary School (HES)**

PACS ID# : **07214**
Work Order # : **026465**

Dematiaceous Fungal Hyphal Elements

Fungal hyphae that are brown to black. No identification to genus level can be made.

Dematiaceous Fungal Spore Elements

Fungal spores that are brown to black. No identification to genus level can be made.

Fungal Spore Elements

Fungal spores that are hyaline or colorless. No identification to genus level can be made.

Cladosporium species

Cladosporium species are found worldwide and are among the most common fungi found in the air, soil, foodstuffs, paint, textiles, bird feathers, and on plants. The hyphae, conidiophores, and conidia are pigmented olivaceous-brown (dematiaceous). Rarely, they can be an opportunist human pathogen causing chromoblastomycosis. They can cause a hypersensitivity pneumonitis known as "hot tub lung disease" and an immediate-type hypersensitivity-type I (IgE-mediated) extrinsic asthma.

Periconia species

A moderately rapid growing fungus that produces a gray, brown, olivaceous, or black colony within fourteen days when incubated at 25C (77F). It has worldwide distribution and has been isolated from soil, herbaceous stems and leaves of plants, grasses and wood. It is primarily a plant pathogen and there have not been any reports of human infections.

Pithomyces species

Pithomyces species have worldwide distribution and are common. It has been isolated from air, soil, plants, fodder grasses and dead leaves. It is the cause of facial eczema in sheep, however, there have not been any reports of human infections.

Rust spores

The spores of a parasite fungus (Basidiomycetes) that form orangish-red or dark colored spots on the leaves and stems of plants. It is called "rust" because of its color. Rust thrives in cool, moist weather, however, reproduction of rust spores occurs throughout the summer months. The fungus usually is not lethal to its host, but may cause stunting and discoloration of the plant. It is not established as a human pathogen.

Other Material Identified from Tape Prep Assays

Client : **Pembroke County K-12**
Jobsite : **Hobomock Elementary School (HES)**

PACS ID # : **07214**
Work Order # : **026465**

"Talc-Like" Particles

These are thin disk-like particles of variable size range (10 to 50 micron). It may be organic or inorganic in nature. In indoor environment these particles mainly come from cornmeal, other grain flour, talcum powder etc. Some of these particles may adversely influence the health of dweller (example talcum powder).

Bird Feathers

Black Particles

These microscopic particles may originate from an organic source material. They greatly vary in their shape and sizes depending on their origin. However, an average size ranges between 1-micron to 5-micron with some exceptions. It may be regular or irregular in shape. In the indoor environment some important source/cause of these particles includes but are not limited to combustion, burning of oil & candles, chimney shoot, automobile exhaust, neoprene (rubber compound that applied to the inside surface of fiber glass duct liner), and other organic materials emitted by copier machines, printers, abraded paints etc.

These particles may influence health and hygienic condition of dwellers.

Reddish-Brown Particles

These microscopic particles may originate from in-organic or organic source materials. In indoor environments these particles mainly come by rusting, coarse, weathering of materials etc. They may also be released into the environment due to deterioration of wood or wood products, art and sculpture work etc. These particles greatly vary in their shape and sizes. It can be measured from a few micron to over 100-microns. This particle may be the indicator of moisture problem in indoor environment.

The health implications of this material are not well established however; it may be significant from a health and hygiene point of view.

Laboratory Analysis Report "Other" Samples

Client: **Pembroke County K-12**
 Jobsite: **Hobomock Elementary School (HES)**
 Location: **Hobomock ES**

PACS ID #: **07214**
 Work Order #: **026465**
 Project Date: **12/15/2020**
 Date Issued: **12/28/2020**

Mech. Unit: **N/A**
 Zone: **Building Pressure**
 Test Site: **Hallway**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192066 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 8:49 am | 9,542 | p/l |
| 192066 | Relative Humidity (RH) Reading | 12/15/2020 | 8:49 am | 38.4 | % |
| 192066 | Temperature Reading | 12/15/2020 | 8:49 am | 34.5 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 100**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192075 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:20 am | Not Detected | |

Mech. Unit: **N/A**
 Zone: **Rm 100**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192073 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:20 am | 6,197 | p/l |
| 192073 | Relative Humidity (RH) Reading | 12/15/2020 | 9:20 am | 18.7 | % |
| 192073 | Temperature Reading | 12/15/2020 | 9:20 am | 70.8 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 145**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192072 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:12 am | Not Detected | |

ND = None Detected. Results are less than the method detection limit.

<= Less Than or Equal To. The analyte was detected but at a level too low to be accurately quantitated. The actual amount is less than or equal to the reported value.

* The VOC's and Formaldehyde analyses are not covered under the scope of EDLab.

The results in this report apply only to the sample(s) specifically listed above and tested at Environmental Diagnostics Laboratory. Unless otherwise noted, samples were received in good condition. Laboratory-prepared Quality Control (QC) samples are analyzed with the samples routinely; however, unless a blank (control) is received, the result for the control is not compared.

Quality Controlled By: 

Approved By: 
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report "Other" Samples

Client: **Pembroke County K-12**
 Jobsite: **Hobomock Elementary School (HES)**
 Location: **Hobomock ES**

PACS ID #: **07214**
 Work Order #: **026465**
 Project Date: **12/15/2020**
 Date Issued: **12/28/2020**

Mech. Unit: **N/A**
 Zone: **Rm 145**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192070 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:12 am | 6,348 | p/l |
| 192070 | Relative Humidity (RH) Reading | 12/15/2020 | 9:12 am | 20.7 | % |
| 192070 | Temperature Reading | 12/15/2020 | 9:12 am | 68.8 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 160**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192069 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:12 am | Not Detected | |

Mech. Unit: **N/A**
 Zone: **Rm 160**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192067 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:12 am | 7,027 | p/l |
| 192067 | Relative Humidity (RH) Reading | 12/15/2020 | 9:12 am | 24.5 | % |
| 192067 | Temperature Reading | 12/15/2020 | 9:12 am | 66.6 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 210**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192090 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:46 am | Not Detected | |

ND = None Detected. Results are less than the method detection limit.

<= Less Than or Equal To. The analyte was detected but at a level too low to be accurately quantitated. The actual amount is less than or equal to the reported value.

* The VOC's and Formaldehyde analyses are not covered under the scope of EDLab.

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Quality Controlled By: _____

Approved By: Rajiv R. Sahay
 Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report "Other" Samples

Client: **Pembroke County K-12**
 Jobsite: **Hobomock Elementary School (HES)**
 Location: **Hobomock ES**

PACS ID #: **07214**
 Work Order #: **026465**
 Project Date: **12/15/2020**
 Date Issued: **12/28/2020**

Mech. Unit: **N/A**
 Zone: **Rm 210**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192088 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:46 am | 8,727 | p/l |
| 192088 | Relative Humidity (RH) Reading | 12/15/2020 | 9:46 am | 19.6 | % |
| 192088 | Temperature Reading | 12/15/2020 | 9:46 am | 72.9 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 225**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192087 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:41 am | Not Detected | |

Mech. Unit: **N/A**
 Zone: **Rm 225**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192085 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:41 am | 6,375 | p/l |
| 192085 | Relative Humidity (RH) Reading | 12/15/2020 | 9:41 am | 21 | % |
| 192085 | Temperature Reading | 12/15/2020 | 9:41 am | 72.9 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 240**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192084 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:36 am | Not Detected | |

ND = None Detected. Results are less than the method detection limit.

<= Less Than or Equal To. The analyte was detected but at a level too low to be accurately quantitated. The actual amount is less than or equal to the reported value.

* The VOC's and Formaldehyde analyses are not covered under the scope of EDLab.

The results in this report apply only to the sample(s) specifically listed above and tested at Environmental Diagnostics Laboratory. Unless otherwise noted, samples were received in good condition. Laboratory-prepared Quality Control (QC) samples are analyzed with the samples routinely; however, unless a blank (control) is received, the result for the control is not compared.

Quality Controlled By: _____

Approved By: Rajiv R. Sahay
 Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report "Other" Samples

Client: **Pembroke County K-12**
 Jobsite: **Hobomock Elementary School (HES)**
 Location: **Hobomock ES**

PACS ID #: **07214**
 Work Order #: **026465**
 Project Date: **12/15/2020**
 Date Issued: **12/28/2020**

Mech. Unit: **N/A**
 Zone: **Rm 240**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192082 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:36 am | 5,023 | p/l |
| 192082 | Relative Humidity (RH) Reading | 12/15/2020 | 9:36 am | 19.8 | % |
| 192082 | Temperature Reading | 12/15/2020 | 9:36 am | 73.2 | °F |

Mech. Unit: **N/A**
 Zone: **Rm 255**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192081 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:31 am | Not Detected | |

Mech. Unit: **N/A**
 Zone: **Rm 255**
 Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192079 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:31 am | 6,902 | p/l |
| 192079 | Relative Humidity (RH) Reading | 12/15/2020 | 9:31 am | 21.1 | % |
| 192079 | Temperature Reading | 12/15/2020 | 9:31 am | 72.7 | °F |

Mech. Unit: **N/A**
 Zone: **Rm M125**
 Test Site: **Door Handle**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|-------------------------|------------|---------|--------------|-------|
| 192078 | SARS-CoV-2/2019 n-CoV-2 | 12/15/2020 | 9:26 am | Not Detected | |

ND = None Detected. Results are less than the method detection limit.

<= Less Than or Equal To. The analyte was detected but at a level too low to be accurately quantitated. The actual amount is less than or equal to the reported value.

* The VOC's and Formaldehyde analyses are not covered under the scope of EDLab.

The results in this report apply only to the sample(s) specifically listed above and tested at Environmental Diagnostics Laboratory. Unless otherwise noted, samples were received in good condition. Laboratory-prepared Quality Control (QC) samples are analyzed with the samples routinely; however, unless a blank (control) is received, the result for the control is not compared.

Quality Controlled By: _____

Approved By: Rajiv R. Sahay
Rajiv R. Sahay, Ph.D.

Laboratory Analysis Report "Other" Samples

Client: **Pembroke County K-12**
Jobsite: **Hobomock Elementary School (HES)**
Location: **Hobomock ES**

PACS ID #: **07214**
Work Order #: **026465**
Project Date: **12/15/2020**
Date Issued: **12/28/2020**

Mech. Unit: **N/A**
Zone: **Rm M125**
Test Site: **Top of Teacher's Desk**

| Sample # | Sample Type | Date | Time | Results | Units |
|----------|---|------------|---------|---------|-------|
| 192076 | Laser Diode Particle Analysis (Respirable Differential) | 12/15/2020 | 9:26 am | 6,707 | p/l |
| 192076 | Relative Humidity (RH) Reading | 12/15/2020 | 9:26 am | 17.9 | % |
| 192076 | Temperature Reading | 12/15/2020 | 9:26 am | 68.4 | °F |

ND = None Detected. Results are less than the method detection limit.

<= Less Than or Equal To. The analyte was detected but at a level too low to be accurately quantitated. The actual amount is less than or equal to the reported value.

* The VOC's and Formaldehyde analyses are not covered under the scope of EDLab.

The results in this report apply only to the sample(s) specifically listed above and tested at Environmental Diagnostics Laboratory. Unless otherwise noted, samples were received in good condition. Laboratory-prepared Quality Control (QC) samples are analyzed with the samples routinely; however, unless a blank (control) is received, the result for the control is not compared.

Quality Controlled By: 

Approved By: 
Rajiv R. Sahay, Ph.D.

NELAC NY 11769
NRPP 103216 AL
NRSB ARL0017

EPA Method #402-R-92-004
Liquid Scintillation
NRPP Device Code 8088
NRSB Device Code 12193

Laboratory Report for:

Property Tested: Project # 7214-26465

Not Indicated

Hobomock Elementary
81 Learning Lane
Pembroke MA 02359


| Log Number | Device Number | Test Exposure Duration: | | | | Area Tested | Result pCi/L |
|------------|---------------|-------------------------|---------|------------|---------|---|--------------|
| 2819706 | 4457513 | 12/14/2020 | 6:56 pm | 12/16/2020 | 7:00 pm | Unit 125 First Floor Room Mrs. Calter | < 0.4 |
| 2819707 | 4457515 | 12/14/2020 | 7:00 pm | 12/16/2020 | 7:01 pm | Unit 100 First Floor Room Mrs. Lefebure | < 0.4 |
| 2819708 | 4457427 | 12/14/2020 | 7:02 pm | 12/16/2020 | 7:03 pm | Unit 145 First Floor Room Mrs. Crehan | < 0.4 |
| 2819709 | 4457458 | 12/14/2020 | 7:03 pm | 12/16/2020 | 7:04 pm | Unit 160 First Floor Room Mr. Wiseman | < 0.4 |
| 2819710 | 4457479 | 12/14/2020 | 7:04 pm | 12/16/2020 | 7:06 pm | Unit 255 First Floor Room Mr. Bechtoler | < 0.4 |
| 2819711 | 4457480 | 12/14/2020 | 7:05 pm | 12/16/2020 | 7:07 pm | Unit 240 First Floor Room Ms. San | 0.4 |
| 2819712 | 4457462 | 12/14/2020 | 7:07 pm | 12/16/2020 | 7:10 pm | Unit 225 First Floor Room Mr. McKay | 0.4 |
| 2819713 | 4457460 | 12/14/2020 | 7:08 pm | 12/16/2020 | 7:11 pm | Unit 210 First Floor Room Mrs. Valeri | < 0.4 |

Comment: AMENDED REPORT on 12/31/2020 to add the ending times. Building Health Check was emailed a copy of this report. A copy of this report was emailed to ddufoe@pureaircontrols.com.

Test Performed By: Placed: W. W. and D. D. Retrieved: W. W. and D. D.

Distributed by: Building Health Check

Date Received: 12/22/2020 Date Logged: 12/22/2020 Date Analyzed: 12/23/2020 Date Reported: 12/23/2020

Report Reviewed By: 

Report Approved By: 

Disclaimer:

Shawn Price, Director of Laboratory Operations, AccuStar Labs

The uncertainty of this radon measurement is +/- 10 %. Factors contributing to uncertainty include statistical variations, daily and seasonal variations in radon concentrations, sample collection techniques and operation of the dwelling. Interference with test conditions may influence the test results.

This report may only be transferred to a third party in its entirety. Analytical results relate to the samples AS RECEIVED BY THE LABORATORY. Results shown on this report represent levels of radon gas measured between the dates shown in the room or area of the site identified above as "Property Tested". Incorrect information will affect results. The results may not be construed as either predictive or supportive of measurements conducted in any area of this structure at any other time. AccuStar Labs, its employees and agents are not responsible for the consequences of any action taken or not taken based upon the results reported or any verbal or written interpretation of the results.



METHODS

Microscopy

Countable settled bioaerosols concentrations were determined by Microscopy using the Tape Lift Preparation Method.

Surface Tape Preparations (Bioscan) provided insight into the identification and composition of surface pollutants. Clear adhesive tape was applied to the surface of interest and then transferred to a microscope slide. Microscopy evaluations were conducted at 200X and 400X magnification of the trapped particles. The results were reported as counts per square centimeter (cts/cm²).

Temperature, Relative Humidity, and Carbon Dioxide

Real time measurements of temperature, relative humidity, carbon dioxide were obtained using a Gray Wolf AdvancedSense Pro Environmental Test Meter along with a IQ 610 probe.

Respirable-size Particle Counts

Respirable-size particle counts were determined using a Laser Diode Particle Counter manufactured by Met One, Model GT-321. Calibration was checked in the field using a purge filter. Cumulative counts for particle range of 0.3 to 5 microns were reported as total particles per liter of air p/l.

Mechanical and Building Hygiene Assessments

Hygiene assessments of the heating, venting and air-conditioning (HVAC) equipment and building environment were completed by qualified technical personnel. Photographic documentation was provided using flash assisted digital technology and color print reproduction.

GUIDELINES FOR INDOOR AIR QUALITY

At present, federal, state, or local standards for unacceptable airborne or surface microbial concentrations do not exist, principally because some individuals are more susceptible to fungal antigens and the allergenicity of each microbe differs. In most cases however, it is expected the prevalence of indoor species identified from the air be similar or identical to the outdoors, albeit in lower concentrations.

Over the past 18 years, over 123,000 samples have been analyzed by the Environmental Diagnostics Laboratory (EDL) and processed in the proprietary database (Computer Assisted Air Management Program: CAAMP) which includes evaluations of over 7,200 buildings, 47,200 test sites, covering all 50 states (4/12). EDL recommends the following Indoor Air Quality Guidelines that pertain to non-industrial or non-specialized environments e.g. offices, homes, schools, hotels, assisted living facilities, etc.

The guidelines are considered to be representative of “normal” indoor environments and are subject to the investigators discretion to interpret the environmental conditions based on the



sampling results, as well as the conditions that existed at the time of the evaluation. In the event recognized pathogenic microorganisms are detected in any assay, the numeric guidelines play a secondary role in the acceptability of the environment and the situation needs to be addressed individually.

Fungal Structures and Nuisance Dust from Surface Tape Imprints collected in the occupiable Spaces

Surface tape imprints collected within the living space are useful in determining extent of fungal matter settled in the environment. It is expected that surfaces in the living space and where routine maintenance and housekeeping is performed would contain traces of fungal structures of approximately 50 counts per square centimeter (50 cts/cm²).

Nuisance dust (Opaque Particles, Skin Cell Fragments, Insect Parts, Fibers, Pollen and Others) settled in the living space is assessed using the Surface Tape Preparation, which is analyzed by direct microscopy. It is expected that surfaces in the living space and where routine maintenance and housekeeping is performed, the levels of Opaque Particles, Skin Cell Fragments, Insect Parts, Fibers, Pollen and Others would be present in trace levels of approximately 3,000, 600, 4, 120, 4, and 650 counts per square centimeter (cts/cm²), respectively.

Fiberglass Fibers

Fiberglass Fibers are nuisance dusts and have been used in the construction industry for decades. Fiberglass fibers are of specific interest for some people because these fibers are considered strong irritants as well as potential carcinogen for humans. Pure Air recommends fiberglass levels below 66 cts/m³ for indoor air, 16 cts/cm² for indoor surfaces and 32 cts/cm² for HVAC.

Respirable-size Particulate

In general, the concentration of respirable-size particles in buildings with good maintenance, air filtration, and acceptable air quality range from 10,000 to 25,000 cts/l. However when the outside air concentrations exceed 75,000 cts/l, the indoor air should contain approximately one-third of the outside air levels.

Comfort

There is no specific set of enforceable values for temperature and relative humidity; however, comfort depends principally on these two factors combined. For minimizing the prevalence of indoor air quality problems (e.g. microbial activity, indoor allergens, asthma, odors, etc.) and preserving the integrity of the building and its contents Pure Air recommends that the relative humidity be maintained in the range of 30 to 60% (as suggested in the 2016 ASHRAE Handbook – HVAC Systems and Equipment, Chapter 22, Page 1). The temperature for the most part is a preference of the occupants and depends on the level of clothing insulation; however, most people at rest will find the environment comfortable somewhere in the range of 72 to 78 °F (as suggested in the ASHRAE Handbook of Fundamentals 2017, p10.16).



Ventilation

Carbon dioxide concentrations were used as surrogate measure to roughly assess the adequacy of the ventilation system. The American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) Standard 62.1-2013 suggests that a space with maintained concentrations not greater than 700 ppm above outdoor air levels will be properly ventilated with respect to human bioeffluents (body odor).

GLOSSARY

The following glossary is a brief informative description pertaining to the bioaerosols detected from the environmental samples submitted for laboratory analysis. The glossary was written in the context of indoor air quality and not on health outcomes or clinical significance, however, as with any other substance, the action level as well as the health risk from exposure to the bioaerosols described depends on the toxicity and concentration, duration and route of exposure and the susceptibility of each individual.

Opaque Particulate

Opaque particulate refers mostly to microscopic dust in the range of 1 to 50 microns and appears opaque under the light microscope. Opaque particles may be of regular or irregular shapes but by and large come from inorganic sources such as pigments, metals and metal oxides, gypsum, degraded paint, ash, silica, limestone, chalk, shell, gravel dust, Portland cement, ceiling tiles, etc. With a ratio of 1 to 3, opaque particles are more common in the outdoor air than in conditioned spaces. Because of their nature, many opaque particles are corrosive and hygroscopic and therefore considered irritants of the skin, eyes and the mucous membranes in general.

Skin Cell Fragments

Skin cell fragments are keratin (a substance that also forms hair and nails) aerosols derived from humans and pet animals. As the epidermal layer continually replaces itself, the outer layer flakes and falls off. It has been estimated that a human will shed tens of millions skin cells each day. Skin cell fragments are microscopic particles that range mostly from 5 to 50-micron size. It is the most common type of dust detected from the air and surfaces of homes and offices. Skin cell fragments are not considered a major allergen; however, it is a medium colonized by bacteria and other flora that may give rise to odor problems and unsanitary conditions if allowed to layer the environment.

Insect Biodetritus

Insect biodetritus or insect parts are allergens commonly found in the air and surfaces of homes, offices, and the outside environment as well. Their presence in high concentrations suggests that the environment under investigation has been subject to moisture and/or infiltration problems. Insect parts have been postulated to have potent antigens that could trigger allergies following exposure; however, many scientists conclude that not sufficient data of reliable quality exists to substantiate this. Insect biodetritus vary in size but mostly range from 5 to 100 microns.



Fibers

Manmade Fibers Plant Fibers and Fiberglass Fibers are grouped in one category and reported as Total Fibers. By and in large, these aerosols are nuisance dusts but their own nature may help identify their source. For instance, manmade fibers are generated within the building and are derived from soft surfaces such as carpets, drapes, clothes, paper products, etc. Plant fibers or trichomes may come from house plants but the vast majority infiltrate from the outside environment. Used in the construction industry for decades, fiberglass fibers are of specific interest for some people because these fibers are considered strong irritants as well as potential carcinogen for humans. Fibers size range mostly from 1 to 1,000 microns.

Pollens

Ranging mostly from 5 to 200 microns size pollen grains are the male reproductive unit of plants and because of its light weight, can be carried long distances suspended in the air. Pollen grains are well known allergens that can give rise to hay fever in susceptible individuals following inhalation. Ragweed, oak, birch, pecan and are most notorious for being highly allergenic pollens.

Fungal elements and spores

Fungal elements and spores are microscopic fragments of filamentous fungi also known as mold. Found in the air and surfaces, fungal elements and spores are common in nature and the indoor environment. They are part of regular house dust and building materials such as drywall, wood products etc. In humid or damp environments, fungal elements and spores may initiate new growth called colonization that is visible to the unaided eye. Ranging mostly from 1 to 50 microns size, fungal elements and spores are typically found scattered in the air and surfaces; however, actual growth is often characterized when found crowded together. Besides causing physical damage to the substrate in which they grow, mold can affect the quality of indoor air and raise health concerns in more than one way: As it feeds and proliferates, mold releases harmful chemicals into the air we breathe. Certain mold species (e.g., *Stachybotrys chartarum* and others) also may contain proteins and toxic substances. Routs of exposure to mold and related effluents include inhalation, direct contact, and ingestion, but due to the individual susceptibility of each person, the concentration, and the duration of exposure the symptoms may differ widely.

Bacteria

Bacteria are single-cell microscopic organisms that range mostly from 1 to 20-micron size. It may be derived from the environment or animals and humans. Most bacterial infections occur mostly by contact or inhaled droplet nuclei. Some bacterial species are beneficial or part of the human flora. Others are used in the production of foods and yet others are pathogenic to humans. Bacterial colonies recovered either from air, surface or bulk samples are useful in identifying abnormal sanitary conditions that may give rise to health concerns.



Others

Black, Reddish-brown, and Talc-like particulates are grouped in the "Other" category. No sufficient data associated with black, reddish-brown, and talk-like particulate exists from office or residential settings for the assessment of exposure and health implications.

Because of the high content of carbon, Black Particulates are mostly organic matter. The average size ranges from 1 to 5 microns and may be derived from multiple sources of the indoor and outdoor environment such as incomplete combustion, burning of oil and candles, chimney soot, automobile exhaust, tonner form copier and printing machines, abraded paints, tire and asphalt dust, forest fires, carbon mines, etc.

Ranging mostly from 5 to 100-micron size, Reddish-brown particulate may be from rusting of ferrous materials, deterioration of wood products some inks and colorants, and drywall dust.

Talc-like particles are disk shaped and range mostly from 10 to 50-micron size. Some possible sources include cornmeal, and other grain flour and talcum powder.

DISCLAIMERS

The results addressed in this report represent the building environmental conditions at the time the evaluation was undertaken. These conditions may change over the course of time as a result of dynamic and/or seasonal factors such as but not limited to occupancy rates, building operations, mechanical performance, weather, sporulation cycles, etc. and apply exclusively to the areas assessed.

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