ACTIVEPURE TECHNOLOGIES: RISK ASSESSMENT

Submitted To:

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EXECUTIVE SUMMARY

In response to a request for a scientific review and subsequent testing/analysis of ActivePure Technologies equipment, a multi-disciplinary scientific review group was formed and tasked with performing a Risk Assessment of ActivePure (AP) photo-oxidation technologies in a real-world setting. The purpose of the Risk Assessment was to identify both the safety and efficacy of the AP product. Once formed, rigorous testing and analysis methodologies were identified to collect data needed to answer research questions (i.e., Does the AP photo-oxidation technology work as described in a safe manner, under expected real-world conditions?). Testing parameters identified were based on nationally validated collection procedures and addressed products potentially generated by the AP technology as well as surrogate testing used to identify efficacy of the AP product. Comparative "exposure limits" were identified based on the populations expected to be exposed. Additionally sound pressure levels were tested to allow the group to opine on potential disturbances to occupants in locations such as childcare, school or office occupancies. An electrical safety check of the equipment occurred.

Upon testing and analysis, no concerns for health or safety were identified. This included exposure concerns for both adult (i.e., over 18) and sensitive populations (i.e., children [under the age of 18] and senior adults [over the age of 65]).

Using hydroxyl radical (·OH), dust and bacterial samples as challenge atmospheres, the AP equipment was identified as working as designed and reducing or eliminating materials in these categories. It is reasonable to assume that based on these results if used according to manufacturer's recommendations, and in combination with an appropriate cleaning program, the tested devices (AP) will continuously eliminate viral particles in air, reduce bacterial loads and minimize other ambient dusts.

BACKGROUND

Microbial contamination and transmission of disease are of particular importance during pandemic conditions, such as the current SARS-CoV-2 (COVID-19) Public Health Emergency.[1] COVID-19 transmission occurs through aerosolized droplets and/or aerosolized particles, hence air sanitation is important. The size of the COVID-19 viral particle is roughly .1 micron (um). Typical bacterium are in the 2-10 um range. In the current exposure to COVID-19 scenario multiple pathways are present, including inhalation of suspended aerosols and reintroduction of viral material from surfaces either through re-aerosolization or the hand to mucus membrane contact routes.

[1] Azar, Alex II: Determination that a Public Health Emergency Exists, U.S. Department of Health and Human Services, Washington, D.C.; January 31, 2020.

To address the current COVID concerns, as well as air quality issues typical to indoor environments, ActivePure Technologies (AP) has designed multiple types of advanced air cleaning units using their technology. The AP technology is described as the production of energy in the UV-C range (irradiation)[2] striking a titanium dioxide based proprietary photocatalyst, forming oxidizers (hydroxyl radicals, superoxides, hydroxide and hydrogen peroxide), and causing decomposition of viral/bacterial materials through continuous oxidation, resulting in decomposition biproducts, including CO_2 and water in air.

As described, ozone (O_3) and volatile organic chemicals are not increased in air with this technology.[3]

Multiple studies have been conducted by AP to address the safety of this device, its efficacy and regulatory status. Some company literature compares the device to other technologies including ventilation, filtration, ionization, UV germicidal irradiation and other photocatalyst oxidizers.

During May 2021, a review of the initial AP literature was performed, which included bibliographical materials and associated footnoted tables. Comments concerning safety, efficacy, regulatory status and a comparison to other devices were proffered. Subsequent to the review, a Risk Assessment provided by a qualified interdisciplinary team was recommended.[4] The purpose of the Risk Assessment was to identify and close apparent gaps in AP product tests validating efficacy and safety of the product.

Specifically, the Risk Assessment was designed to:

a. Identify all products and byproducts of concern produced during use when the AP devices are installed in real-world circumstances;
b. Describe all potential exposure pathways to individuals occupying rooms and buildings where AP devices are installed;
c. Conduct testing per validated methodologies where possible, analyzed at laboratories which participate in nationally recognized quality assurance and accreditation programs for analytes of concern and compare the results to an appropriately selected exposure criteria, based on the population potentially exposed; and
d. Determine the efficacy of the system through the testing process.

This recommendation was offered to AP in a report on May 19, 2021.[5]

Subsequently, Cocciardi[6] provided a roadmap for this activity to AP, in a proposal of services June 19, 2021, which was approved July 1, 2021, with the following tasks identified.

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[2] The UV-C range is considered to be 100 nm to 280 nm or short wave (germicidal) lengths, causing damage to the nuclei acid of microorganisms.
[3] A review of AP devices identifies that there are some which are designed to produce O_3 and are sold as such. These devices are not reviewed in this Risk Assessment.
[4] This Risk Assessment process was first described by the National Research Council (NRC), 1983, and the format has been continuously utilized: See U.S. EPA: www.epa.gov/risk/human-health-risk-assessment.
[5] Cocciardi, J.A., PhD to Sara Love Rawlings: Review of Materials Provided: ActivePure Technology; May 19, 2021.
[6] Cocciardi, J.A., PhD to Joe Urso, CEO, AP: Proposal of Services: Risk Assessment; June 9, 2021.

TASK #1: Assembly of an independent scientific review panel representing the following disciplines: Industrial Hygiene; Environmental Medicine; Ventilation Engineering and Chemical Behaviors. This group would perform the following functions:

a. Review current materials provided by AP describing the technology and construction of the specific AP Photocatalytic Oxidation (PCO) units.
b. Identify scenarios for human exposure to intermediary or final process products, considering both environmental conditions and/or the medical condition(s) of the recipient. This would include the validation of a real-world test location capable of replicating real-world plausible scenarios.

TASK #2: Identification of applicable exposure limits for comparison purposes. These limits would consider the receptor population, as well as the potential duration of exposure to any identified products.

TASK #3: Identification of collection, testing and analysis methodologies to determine potential exposures through the exposure pathways selected. Specifically,

a. Credentialling of laboratories to participate in the process. (Selected laboratories will participate in an appropriate nationally recognized accreditation program, if one exists for the parameters considered.)[7]
b. Identification of alternate or site testing protocol and procedures, where laboratory analysis protocol would not meet this testing need, and validation of the site protocol(s).
c. Performance of testing under the direction of a Certified Industrial Hygienist.
d. Development of a written report of findings with conclusions and recommendations identified.

TASK #4: Identification of testing/modelling of alternative air cleaning technologies for comparative purposes, and implementation of the schedule above, if commissioned to test these additional technologies.

The above stepped approach ensured all potential exposure scenarios within the scope were identified and maintained quality control/quality assurance during the Risk Assessment process.

[7] Programs such as the American Industrial Hygiene Association (AIHA) Laboratory Accreditation Programs, LLC, are typical of nationally recognized accreditation programs in this area.

ACTIVITIES

Task 1 activities included the assembly of an independent review panel (scientific work group), and a review of the materials and testing to date (provided by AP). Question(s) to be answered by the Risk Assessment would be developed in later tasks.[8] The following individuals and disciplines were identified for participation on the scientific review panel.

Cynthia Fowler, PE: Ms. Fowler is a Heating, Ventilation and Air Conditioning (HVAC) design, installation and test engineer and an active member of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). She possesses 20 years of HVAC commissioning experience and represents the engineering expertise for the Work Group.

Kevin Yeskey, MD: Dr. Yeskey, also involved on the initial AP review, provides vast health and human service expertise. He was formerly the Principal Deputy to the Assistant Secretary for Preparedness and Response at the U.S. Department of Health and Human Services (ASPR-HHS). Dr. Yeskey provides the medical expertise for the Work Group.

Victoria Stanavitch, PhD: Dr. Stanavitch is the Chair of the Sciences Department at Keystone College, and a trained/experienced public health epidemiologist. Dr. Stanavitch provides the biochemistry expertise to the Work Group.

[8] The following materials were reviewed:

1. Canadian Hospital Study (Cardio & Surgical ICUs) - Data collections done by ActivePure personnel
   Filename: Aerus ActivePure ICU_CanadaStudyReport_20201 cps edits_Clean.pdf
2. Canadian Hospital Study (supplemental sample collection and analysis) - Data collections done by Hospital Industrial Hygienist
   Filename: Bacteriology Sampling Report-HSC-Surgical ICU-June 24 2019 reviewed.pdf
3. Texas Hospital System Study
   Filename: Generic Hospital Operating Room Report cps edits_clean.pdf
4. ActivePure Testing on Ozone Production (for FDA Submission)
   Filename: Aerus Medical Guardian Ozone testing.pdf
5. Formaldehyde Testing
   Filename: Aerus Formaldehyde testing Public Version.pdf
6. Summary Data: Independent Laboratory Testing
   Filename: SARS-CoV-2 Testing Charts[1].pdf
7. Efficacy of Medical guardian Against Various Aerosols
   Filename: MedicalGuardian_BioTestResults.pdf
8. University of Texas Medical Branch Testing on Product Efficacy
   Filename: UTMB Final Report_12.2020.pdf
9. MRI Global Testing on Product Efficacy
   Filename: Medical Testing Graphs.pdf
10. Hydroxyl Blaster Efficacy in Remediating SARS-CoV-2
    SARS_CoV_2_HydroxylBlaster_Testing.pdf
11. ActivePure Testing on Byproduct Production (for FDA Submission)
    Aerus Medical Guardian Organic Oxidization By-products.pdf

Joseph A. Cocciardi, PhD, CIH, CSP, REHS/RS is identified as the lead for the team. Dr. Cocciardi, an environmental health practitioner with vast experience in the Risk Assessment process, authored the initial AP document review. He is responsible for the industrial hygiene expertise for the group, exposure assessment parameters and discussions, as well as supervision of site Industrial Hygienists who performed collections, testing or site analysis.

Curricula vitae's for the team were previously forwarded to AP.

Subsequent to approval[9] by AP, the group reviewed the AP Technologies information, the previous COCCIARDI report and documents/tests provided by AP. The group provided initial reviews of documentation by July 20, 2021. A summary of comments and interim conclusions is found in the sections below.

ENGINEERING OVERVIEW

Thermal comfort and indoor air quality are both affected by the design of a room's conditioned air distribution as indicated in ANSI/ASHRAE Standard 62.1 *Ventilation for Acceptable Indoor Air Quality*.[10] The effectiveness of AP units depends on the existing air distribution design, which must be installed correctly and properly maintained for optimal performance. Poorly designed systems or low velocities may cause temperature stratifications in rooms and unbalanced air flows. Velocities which would affect unit efficacy are not specified in the information provided and reviewed, subsequently uniform distribution of air may not occur. Additionally, placement of typical MERV 8-13 filter in HVAC systems may impede efficacy of the AP units, depending on placement of the units if in the HVAC system. Placement of the units in relationship to any humidification units is also imperative.

There is no way to compensate for poor system design, hence all systems must be maintained properly. The ventilation rate procedure described in ASHRAE 62.1 is used most often and it not only takes into account the room square footage, space use and number of people but also assigns a value for Air Distribution Effectiveness, E_2, which considers where in the room, how warm and how fast the air is delivered into the space. Fluid dynamics in the room caused by the existing design of the air distribution system can be expected to have an impact on the output of the AP technology whether it is deployed in the existing ductwork or in the room. The following considerations are identified:

[9] A non-disclosure agreement was confirmed as in place prior to initiation of activities.
[10] American Society of Heating, Refrigeration and Air Conditioning Engineers: Standard 62.1: Ventilation for Acceptable Indoor Air Quality; Peachtree Corners, GA; 2019.

Room Installation Considerations

To test the effectiveness of the AP technology for in-room installation, ceiling or other fans placed in the room set for various speeds or configurations of fan speed/fan off/fan on would simulate a variety of air distribution scenarios. For classrooms with wall-mounted or floor mounted air distribution, fans placed at the center of the wall and at both ends of the wall between 30- and 36-inches above finished floor is recommended to simulate air flow patterns in the room.

The effectiveness of duct installation depends on the quality of air distribution design and the quality of system maintenance. Poor duct air distribution design and dirty filters at the air handler have the potential of lowering air velocities to below that originally designed. Subsequently, inspection and maintenance of these systems is essential. Additionally, high temperature air flow with low air velocity can cause temperature stratification in the room.

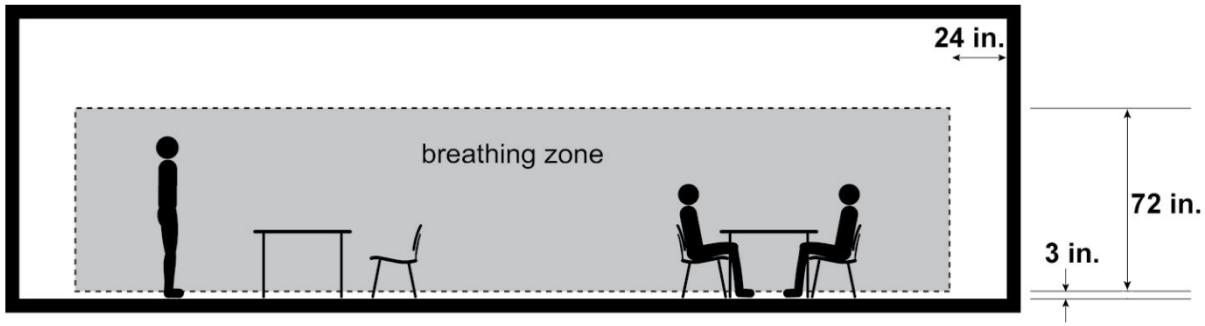


Figure 6-A Breathing Zone

FIGURE 1: BREATHING ZONE AREAS OF CONCERN (ASHRAE 62.1)

MEDICAL OVERVIEW

The medical/exposure analysis performed reviewed the literature concerning the infective dose and characteristics of COVID-19, the present agent of concern. There is not an infective dose (ID) of COVID-19 identified in the literature. The infectious dose of COVID-19 is not known as challenge studies have not and are not planned to be performed. Although unclassified by the U.S. Centers for Disease Control, any testing using actual COVID-19 viral particulate must be performed in a highly protective and regulated atmosphere. Some estimates from other similar infectious diseases and animal studies suggest the following:

Karimzadeh et al: Prepublication (not peer reviewed); A review of infectious dose of COVID-19 was posted October 2020. An estimate of the infectious dose is greater than 100 particles, but less than 700 particles, based on a review of the scant literature on this topic and the understanding of the infectious dose of other similar respiratory diseases.

Schroder, I: A Risk Assessment (2020): Estimates the human ID (50) is approximately 790 viral particles based on comparisons to Influenza A ID (50) for aerosolized virus particles.

Watanabe et al (2010): Although an older article about SARS, this discussion estimates the ID (50) for SARS at 280 plaque forming units (CI= 130 and 530 PFU). This may be useful for comparison purposes to the COVID-19 virus.

The CDC offers no estimates in publications of COVID-19 ID (50).

While it has been presumed that SARS-CoV-2 spreads primarily via droplet spread and fomites, recent scientific discussions have found this virus spreads via aerosols as well.[11] The discussion is ongoing.

Hence, the use of surrogate biological substance is recommended for the testing phase of this Risk Assessment, for both safety and logistical purposes. Surrogate information is described below.

BIOCHEMICAL OVERVIEW

Based on common chemical and biological principles, a literature search was conducted to determine the potential toxins that could be generated using titanium dioxide as a catalyst for hydroxyl radical generation via ActivePure technology. The following potential toxins were identified: carbon monoxide, hydrogen peroxide, formaldehyde, acetaldehyde, ozone, and titanium nanoparticles. In addition, potential surrogates for SARS-CoV-2 and other microbial pathogens were identified which could be used for proof testing. While the influenza virus is a common surrogate used to test for activity against the SARS-CoV-2 virus, it requires special safety precautions to prevent infection in testing personnel. Human subjects concerns may also present. To alleviate this risk to testing personnel, the following surrogates are suggested: MS2 bacteriophage, *Staphylococcus epidermidis*, *E. coli*, *Aspergillus niger*, and *Bacillus globigii*. To alleviate this risk to occupants, in particular to those who may be considered "AT-RISK" groups, serious consideration should be given to the elimination of biological surrogates OR a detailed human subjects review and research conducted be monitored by an Institutional Review Board (IRB) or Independent Ethics Commission (IEC). This board would not appear to be required if ambient environmental testing, versus the introduction of a bacteriological or viral surrogate into the occupied environment, occurred.

Subsequently, testing commenced on a method to determine the concentration of hydroxyl radicals formed by this technology in air as no current laboratory protocol had been found. The testing identified methylene blue soaked Whatman filter paper strips as a viable testing method. They were tested with

[11] https://www.thelancet.com/article/S0140-6736(21)00869-2/fulltext

varying concentrations of methylene blue. The length of exposure was tested and identified, as the methylene blue strips were exposed to hydroxyl radicals. The strips lighten in color and/or return to the original white color based on time of exposure. The method testing concluded that this fluid test could be used to identify the presence of hydroxy radicals in air,[12] as well as the timeframe for the persistence of ·OH. The utilized method is appended.

HYGIENE AND SANITATION OVERVIEW

Industrial Hygiene testing parameters offered by the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH), the U.S. Environmental Protection Agency (EPA) and various independent laboratories were reviewed, relative to the toxins and materials expected to be generated by the AP technology as identified by the Scientific Review Committee. The selected testing methods are described and are identified in Table 1, below.

[12] This proof testing was performed under controlled conditions, at Keystone College, La Plume, Pennsylvania, during August 2021, under the direction of Dr. Victoria Stanavitch.

TABLE 1
TESTING PARAMETERS: ACTIVEPURE TECHNOLOGIES

Analyte	TiO2 in nanoparticle range	O3	PM 10	VOC profile	UV light	Temp & rH%	Noise	Microbial Testing	Hydroxyl Radical Testing
Analytical Technique	Modified NIOSH 7300* (See FIGURE 2 below)	Direct Read	Mod. NIOSH 0500 Gravimetric	Mod. Multiple NIOSH Methods	Direct Read	Direct Read	Direct Read	Plate Counts	Methylene Blue Test Strips
Method of Collection	PVC NIOSH Method 0600 and duplicate sample on MCEF	Ohio Lumix nanO3 Ozone Monitor	37mm 3-piece PVC cassette with 5.0 micron pre-weighted PVC filter sampled with cyclone (dorr oliver, higgins-dewell, or aluminum)	Coconut shell charcoal sorbent tube and personal sampling pump (volatile organic sampling train)	ILT2400 Handheld UV-Curing Light Measurement Meter	TSI IAQ-Calc 7545	Type 1 Sound Level Meter	Surfaces - Swab sampling; Air Sampling; Follow the All-Tech Environmental Services Methods	Air Exposure Sampling
Analytical Method	PVC - ICP NIOSH Method 7300 MCEF - transmission electron microscopy (TEM)	Ultraviolet atomic absorption at 254 nm	Gravimetric filter weight	Gas Chromatography Flame Ionizing Detector	Hand-Held Light Meter & Optometer	Thermistor (Temp) & Thin-film capacitive	½ Free field Electret microphone & preamplifier - Type 1	Plate Counts	Color change indicates presence of radicals
Estimated Limit of Detection	100 nm	3.0 ppb (2 σ)	0.1 micrometer	Substance dependent					Qualitative sampling method
Reporting Units	Nanoparticles/cc	ppb	mg/m^3	ppm	amps, lux, and fc	°F/°C and % rH	dBA or dBC	CFU (colony forming units)	present or absent
Resolution		0.1 ppb				0.1°F (0.1°C) & 0.1% RH			
Range		0 ppb to 10 ppm			50pA – 1mA current, 8 decades of light intensity measurements	32 to 140°F (0 to 60°C) and 5% to 95% RH	10dB - 140dB		
Accuracy		Greater of 2 ppb or 2% of reading			peaks as brief as 100µS	±1.0°F (±0.5°C) & ±3.0% RH			

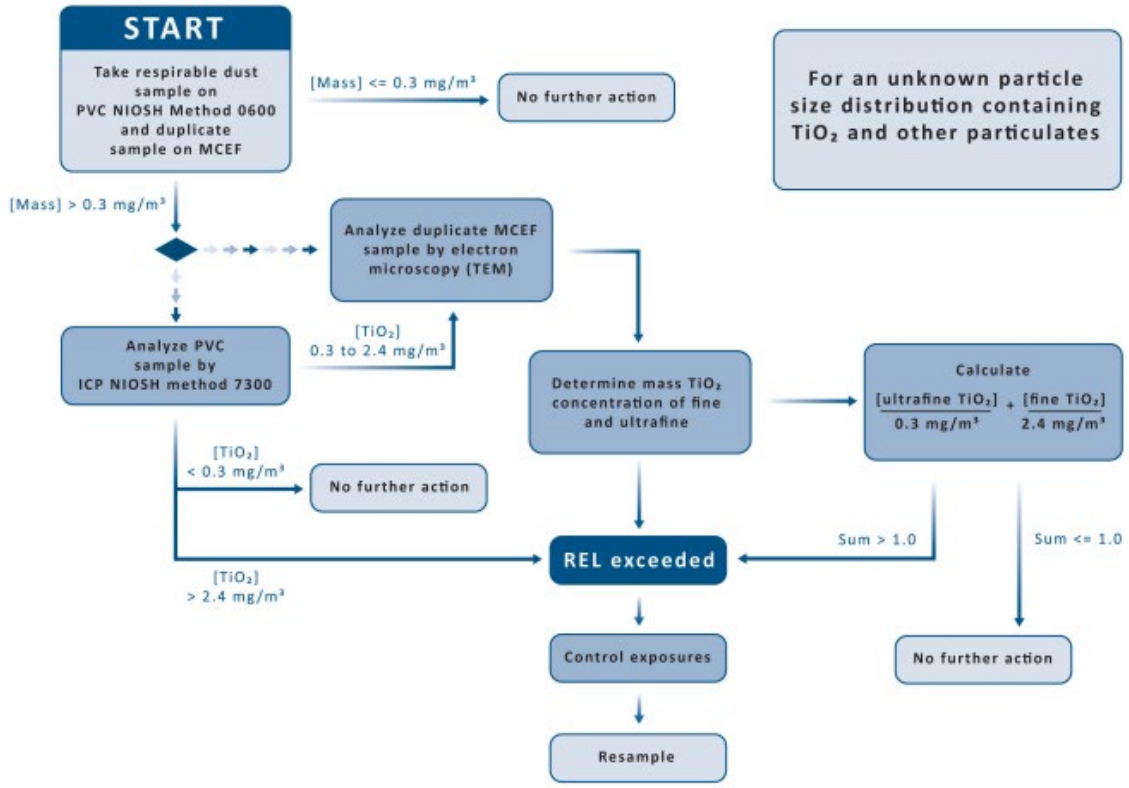
TABLE 1 (CONTINUED)
TESTING PARAMETERS: ACTIVEPURE TECHNOLOGIES

Analyte	TiO2 in nanoparticle range	O3	PM 10	VOC profile	UV light	Temp & rH%	Noise	Microbial Testing	Hydroxyl Radical Testing
Measurement Intervals		10 seconds			peaks as brief as 100µS	1 second up to 1 hour (user selectable) Response time - 30 seconds (90% of final value, air velocity at 400 ft/min [2 m/s]) & 20 seconds (for 63% of final value)	LAVG or LEQ, Max, Peak and Overload Indication at one minute intervals	Growth on plates monitored for 24, 48, 72, and 96 hours. Plates incubated at 30 degrees Celsius	We are currently testing these intervals
Flow Rate	Depends on cyclone utilized Dorr Oliver - 1.7 lpm Aluminum - 2.5 lpm	~0.5 lpm	CYCLONE: Dorr Oliver - 1.7 lpm Aluminum - 2.5 lpm	0.01-2.0 lpm					
Baseline Drift		<2 ppb/day & <5ppb/year							
Sensitivity Drift		<1%/day & <3%/year							

TABLE 1 (CONTINUED)
TESTING PARAMETERS: ACTIVEPURE TECHNOLOGIES

Analyte	TiO2 in nanoparticle range	O3	PM 10	VOC profile	UV light	Temp & rH%	Noise	Microbial Testing	Hydroxyl Radical Testing
Exposure Limits and Sources	See TABLE 2 See TABLE 3	See TABLE 2 See TABLE 3	See TABLE 2 See TABLE 3	Substance dependent	Exposure limits are wavelength and effective irradiance dependent. There are also different exposure limits for exposures to the skin or eyes. The 2021 ACGIH TLV and BEI booklet has UV radiation exposure limits listed in Table 1 under the Optical Radiation Section (pg 154).	ASHRAE 55-2017 recommends occupied building areas be maintained between 68.5˚F and 75˚F during the winter season, and 75˚F and 80.5˚F during the summer season. The Standard requires that systems designed to control humidity must be able to maintain a dewpoint temperature of 16.8°C (62.2°F). There are no established lower humidity limits for thermal comfort; consequently, Standard 55 does not specify a minimum humidity level.	To be able to hear and understand spoken messages in classrooms, the WHO recommends background sound pressure level should not exceed 35 dBA Leq during teaching sessions - https://www.who.int/docstore/peh/noise/Comnoise-4.pdf The USEPA recognizes levels of 55 decibels outdoors and 45 decibels indoors as preventing activity interference and annoyance. - USEPA April 2, 1972 press release		

A further delineation of testing and analysis for nanoparticles (TiO_2) is found in the Figure 2, below. TiO_2 nanoparticles have recently been identified as a potential human carcinogen by the American Conference of Governmental Industrial Hygienists and others, hence a specialized review of testing methodologies was needed.[13]



Exposure assessment protocol for TiO_2

FIGURE 2: TITANIUM DIOXIDE TESTING PROCESS: CDC/NIOSH

(Source: National Institute for Occupational Safety and Health[14])

Based on the information above, validated test methodologies exist for the collection and analysis of ozone, particulate matter, volatile organic compounds, ultraviolet light, temperature, relative humidity and noise.

Proposed testing methodologies are identified for Titanium Dioxide nanoparticles in Figure 2.

[13] American Conference of Governmental Industrial Hygienists: Notice of Intended Change; Threshold Limit Values and Biological Exposure Indices: Carcinogenicity: Cincinnati, Ohio; 2021.
[14] Centers for Disease Control and Prevention: Current Intelligence Bulletin #63: Occupational Exposure to Titanium Dioxide: Figure 2: Exposure Assessment Protocol for TiO_2: National Institute for Occupational Safety and Health (NIOSH): DHHS (NIOSH) Public No. 2011-160; 2011.

A qualitative test process has been identified to identify the presence of superoxides in air.

The use of either COVID-19 or biological surrogates for COVID-19 to test the efficacy of the superoxide process in an occupied area with potential human exposure will not be pursued as part of this risk assessment. The testing for upstream products (superoxides) and downstream indicators of efficacy will be pursued.

EXPOSURE LIMIT REVIEW

To answer the question: Are devices safe? [What exposure standards apply and when? Who is protected by these standards?] two types of exposure limits were reviewed. Exposure standards fall into two categories: Occupational Exposure Limits (OEL) and Public Exposure Guidelines. Public exposure standards are generally more conservative, as they are designed to protect all populations (including the very young and very old) and consider time sensitive duration exposures.

Occupational Standards are proffered by the U.S. Department of Labor – Occupational Safety and Health Administration (OSHA) [Permissible Exposure Limits: PEL], the U.S. Department of Health and Human Services – National Institute for Occupational Safety and Health (NIOSH) [Recommended Exposure Limits: REL], the American Conference of Governmental Industrial Hygienists (ACGGIH) [Threshold Limit Values: TLV] and various states (e.g., the California Department of Labor – CAL OSHA). The American Industrial Hygiene Association (AIHA) also offers Workplace Employee Exposure Levels (WEEL) for certain substances not covered by other cited agencies. Limits are time sensitive (and in general, the lower the concentration the longer the exposure); however, some substances have CEILING and SHORT-TERM concentrations published. These are levels above which no exposure should occur. Again, the concern with OEL is that they target the adult population (18 years of age and older) and many do not take into account the at-risk populations.

Of the standards cited, the CAL OSHA standards are the only ones annually updated.

A variety of public exposure limits are also proffered and fall into 3 categories: Emergent Exposure Levels, Duration (for an event) Levels and Lifetime Exposure Levels. Emergent Levels are published by the National Academy of Science and are set by consensus (AEGL – Acute Exposure Guideline Levels), the American Industrial Hygiene Association (ERPG – Emergency Response Planning Guides) and the U.S. Department of Energy (TEEL – Temporary Emergency Exposure Limits). All of the above exposure levels are risk/outcome/time sensitive. Duration exposure limit calculations called Reference Doses or Hazard Quotients are published by the U.S. Environmental Protection Agency (EPA), and are published for various intervals and time limits, e.g., 1 week – 10 weeks – 7 years or a lifetime (70 years). The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) publishes Minimal Risk Levels (MRL): The level of human exposure to all populations that is without appreciable non-cancer risk (oral and inhalation values) and they are published for a week, a year, and a lifetime. These MRLs are screening levels with safety factors (No Observed Effects Level). Lifetime exposure values such as the National Ambient Air Quality standards (NAAQS) and carcinogenic Reference Doses and Reference Concentrations are also calculable. NAAQS cites 6 reference substances, of these O3 and PM are applicable to our study. Primary NAAQS protect the health of sensitive populations including asthmatics, children, and the elderly.

While agents generated by AP products may exist in both occupational and public environments, populations of all ages may be exposed, and hence the most protective limits should be applied.

TABLE 2
OCCUPATIONAL HEALTH EXPOSURE VALUES APPLICABLE TO THE AP STUDY

Analyte	OSHA	Cal OSHA	NIOSH	ACGIH
CO[15]	50 ppm PEL, 55 mg/m^3 PEL	25 ppm PEL, 200 ppm Ceiling	35 ppm REL, 200 ppm Ceiling	25 ppm PEL
CO_2[15]	5,000 ppm PEL, 9,000 mg/m^3 PEL	5,000 ppm PEL, 30,000 ppm STEL	5,000 ppm 1 REL, 30,000 ppm STEL	5,000 ppm 8-hr.-TWA, 30,000 ppm STEL
Acetaldehyde[15]	200 ppm PEL, 360 mg/m^3 PEL	25 ppm Ceiling	N/A	25 ppm Ceiling
Formaldehyde[15,16]	0.75 ppm PEL, 2 ppm STEL	0.75 ppm PEL, 2 ppm STEL	0.016 ppm REL, 0.1 ppm Ceiling (15-minute)	0.1 ppm, 0.3 ppm STEL
O_3[15]	0.1 ppm PEL, 0.2 mg/m^3 PEL	0.1 ppm PEL, 0.3 ppm STEL	0.1 ppm Ceiling	0.05-0.20 ppm depending on workload/time
TiO_2 Nanoparticles[15]	N/A	N/A	0.3 mg/m^3 REL	N/A
VOCs	N/A	N/A	N/A	N/A
Hydrogen Peroxide[15]	1 ppm PEL, 1.4 mg/m^3 PEL	1 ppm PEL	1 ppm REL	1 ppm PEL

Table Notes: ppm: parts per million
mg/m^3: milligrams per cubic meter
PEL: Permissible Exposure Limit, 8-hr. Time-Weighted Average
REL: Recommended Exposure Limit, 10-hr. Time-Weighted Average
STEL: Short-Term Exposure Limit

[15] Permissible Exposure Limits – OSHA Annotated Table Z-1 | Occupational Safety and Health Administration.
[16] 1910.1048 - Formaldehyde. | Occupational Safety and Health Administration (osha.gov).

TABLE 3 PUBLIC HEALTH EXPOSURE VALUES APPLICABLE TO THE AP STUDY						
Analyte	**ATSDR MRL**	**EPA NAAQS**	**AIHA ERPG 1**	**AIHA ERPG 2**	**AIHA ERPG 3**	**TEEL/PAC**
CO	N/A	9 ppm/8 hrs., 35 ppm/1 hr.[17]	200 ppm[18]	350 ppm[18]	500 ppm[18]	(ppm) PAC-1: 75 PAC-2: 83 PAC-3: 330 (mg/m^3) PAC-1: 86 PAC-2: 95 PAC-3: 380[19]
CO_2	N/A	N/A	N/A	N/A	N/A	N/A
Acetaldehyde	N/A	N/A	10 ppm[20]	200 ppm[20]	1,000 ppm[20]	(ppm) PAC-1: 45 PAC-2: 270 PAC-3: 840 (mg/m^3) PAC-1: 81 PAC-2: 490 PAC-3: 1,500[21]

[17] NAAQS Table | US EPA
[18] CARBON MONOXIDE | CAMEO Chemicals | NOAA
[19] Chemical Safety Program: PACs for Chemicals of Concern - Reports (energy.gov)
[20] ACETALDEHYDE | CAMEO Chemicals | NOAA
[21] Chemical Safety Program: PACs for Chemicals of Concern - Reports (energy.gov)

TABLE 3 (CONTINUED)
PUBLIC HEALTH EXPOSURE VALUES APPLICABLE TO THE AP STUDY

Analyte	ATSDR MRL	EPA NAAQS	AIHA ERPG 1	AIHA ERPG 2	AIHA ERPG 3	TEEL/PAC
Formaldehyde	Acute inhalation: 0.04 ppm Intermediate inhalation: 0.03 ppm Chronic Inhalation: 0.008 ppm Intermediate oral: 0.3 mg/kg/day Chronic oral: 0.2 mg/kg/day	N/A	1 ppm[22]	10 ppm[22]	40 ppm[22]	(ppm) PAC-1: 0.9 PAC-2: 14 PAC-3: 56 (mg/m^3) PAC-1: 1.1 PAC-2: 17 PAC-3: 69[23]
O_3	N/A	.070 ppm/8 hrs.	N/A	N/A	N/A	(ppm) PAC-1: 0.24 PAC-2: 1 PAC-3: 10 (mg/m^3) PAC-1: 0.47 PAC-2: 2 PAC-3: 20[24]
TiO_2 Nanoparticles	N/A	N/A	N/A	N/A	N/A	N/A
VOCs	N/A	N/A	N/A	N/A	N/A	N/A

[22] FORMALDEHYDE | CAMEO Chemicals | NOAA
[23] Chemical Safety Program: PACs for Chemicals of Concern - Reports (energy.gov)
[24] Chemical Safety Program: PACs for Chemicals of Concern - Reports (energy.gov)

TABLE 3 (CONTINUED) PUBLIC HEALTH EXPOSURE VALUES APPLICABLE TO THE AP STUDY						
Analyte	**ATSDR MRL**	**EPA NAAQS**	**AIHA ERPG 1**	**AIHA ERPG 2**	**AIHA ERPG 3**	**TEEL/PAC**
Hydrogen Peroxide	N/A	N/A	10 ppm[25]	50 ppm[25]	100 ppm[25]	(ppm) PAC-1: 10 PAC-2: 50 PAC-3: 100 (mg/m^3) PAC-1: 14 PAC-2: 70 PAC-3: 140

Table Notes: ppm: parts per million
mg/m^3: milligrams per cubic meter

[25] HYDROGEN PEROXIDE, STABILIZED | CAMEO Chemicals | NOAA

TABLE 4 PUBLIC EXPOSURE VALUES APPLICABLE TO THE AP STUDY AEGL VALUES						
CO[26]		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	NR	NR	NR	NR	NR
	AEGL: 2	420	150	83	33	27
	AEGL: 3	1,700	600	330	150	130
CO_2		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	N/A	N/A	N/A	N/A	N/A
	AEGL: 2	N/A	N/A	N/A	N/A	N/A
	AEGL: 3	N/A	N/A	N/A	N/A	N/A
Formaldehyde[27]		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	0.90	0.90	0.90	0.90	0.90
	AEGL: 2	14	14	14	14	14
	AEGL: 3	100	70	56	35	35
Acetaldehyde[28]		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	45	45	45	45	45
	AEGL: 2	340	340	270	170	110
	AEGL: 3	1100	1100	840	530	260
O_3		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	N/A	N/A	N/A	N/A	N/A
	AEGL: 2	N/A	N/A	N/A	N/A	N/A
	AEGL: 3	N/A	N/A	N/A	N/A	N/A
TiO_2 Nanoparticles		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	N/A	N/A	N/A	N/A	N/A
	AEGL: 2	N/A	N/A	N/A	N/A	N/A
	AEGL: 3	N/A	N/A	N/A	N/A	N/A
VOCs		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	N/A	N/A	N/A	N/A	N/A
	AEGL: 2	N/A	N/A	N/A	N/A	N/A
	AEGL: 3	N/A	N/A	N/A	N/A	N/A
Hydrogen Peroxide		10 min	30 min	60 min	4 hr.	8 hr.
	AEGL: 1	N/A	N/A	N/A	N/A	N/A
	AEGL: 2	N/A	N/A	N/A	N/A	N/A
	AEGL: 3	N/A	N/A	N/A	N/A	N/A

RECOMMENDED EXPOSURE CRITERIA for ACTIVEPURE: All exposures below ATSDR MRL (Lifetime criteria) AND NAAQS O3/PM levels – with no single exposure above an occupational SHORT-TERM Limit. Adoption of this limit addresses all byproducts for all populations.

[26] Carbon Monoxide - AEGL Program | US EPA
[27] Formaldehyde - AEGL Program | US EPA
[28] Acetaldehyde - AEGL Program | US EPA

TESTING FOR COVID-19 SURROGATES

In addition to the exposure criteria above, testing to determine efficacy of the system has been recommended. While an Infective Dose for COVID 19 (ID50) has not been identified, a qualitative YES or NO answer is possible. This answer may be interpolated from the continual presence of ·OH in air in an occupied building. The HVAC system review[29] has addressed the mechanism of spread of both hydroxy radicals and viral particulate matter. To test efficacy (e.g., air distribution) testing for the presence of ·OH was recommended/used.[30] To test efficacy this should occur at different times during the HVAC system cycle.

TESTING FOR SOUND PRESSURE LEVELS

In addition to chemical substances, the AP equipment may generate sound pressures, and hence the testing for sound pressure levels in occupiable areas adjacent to the equipment (if installed in a portable format) was recommended. While occupational noise limits exist, as they do for chemical substances, ambient public exposure limits to protect against both hearing loss and interference/annoyance are adopted locally with recommendations proffered by the U.S. Environmental Protection Agency.[31] The EPA identifies a 24-hour exposure level of 70 decibels as the level of environmental noise which will prevent any measurable hearing loss over a lifetime. Likewise, levels of 55 decibels outdoors and 45 decibels indoors are identified as preventing activity interference and annoyance. These levels of noise are considered those which will permit spoken conversation and other activities such as sleeping, working and recreation, which are part of the daily human condition.

The levels are not single event, or "peak" levels. Instead, they represent averages of acoustic energy over periods of time such as 8 hours or 24 hours, and over long periods of time such as years. For example, occasional higher noise levels would be consistent with a 24-hour energy average of 70 decibels, as long as a sufficient amount of relative quiet is experienced for the remaining period of time. Subsequently, a level of 45 dB indoors over a monitoring period, with a level not to exceed 70 dB over a full 24-hour period has been adopted as applicable to AP devices, to preclude interference and annoyance. The Work Group recommends that this level be confirmed by test.

[29] A recommendation to place a statement in AP owner's manuals and installation literature to maintain all HVAC systems according to manufacturer's instructions and the most current American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) standard was made to AP as a part of this project.
[30] Use of COVID-19 in a test scenario is not recommended, due to the unknown ID(50). Recommended surrogates MS-2 bacteriophage, Staphylococcus epidermis; E.coli, Aspergillus Niger and Bacillus globigii were not recommended due to the presence of human subjects as receptors.
[31] U.S. Environmental Protection Agency: Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety; U.S. EPA 550/9-74-004, 1974; Washington, D.C.

RESEARCH QUESTIONS

Based on the literature reviewed, the research performed by the scientific review committee and the discussions which occurred, the following research question with assumptions has been identified as the focus of this Risk Assessment:

A. Do identified AP devices using the same class of technology (either free-standing or system installed) produce items of harm and/or generate substances which may control viral particulate matter in the 0-6' foot range in a "designated occupiable space", when appropriately sized for the equipment and challenged with:

   Humidity – Low and high rH ranges, based on ASHRAE criteria;
   Temperature – Low and high temperatures, based on ASHRAE criteria;
   Natural and artificial light; and
   Temporal changes – Introduction 1-2 hours before occupancy and/or testing throughout occupancy?

Testing and analysis recommendations are based on the review provided by the Work Group. An ideal testing location would have the following characteristics:

- This site would represent an occupancy for all age groups and characterize both occupational and public exposures.
- This site would have a variable environment, characterizing the hazards and risks identified above, within standard occupancy criteria.
- The site would not pose an unreasonable risk to either researchers or others who may be occupant during or subsequent to testing.
- The site would meet applicable building and property maintenance codes.

The testing location identified was the Lamplighter School (11611 Inwood Road, Dallas, Texas 75229). This school location is currently coded and maintains occupancy permits as such.[32]

[32] Additional information concerning the LAMPLIGHTER SCHOOL can be viewed at www.thelamplighterschool.org.

ON-SITE ACTIONS

Prior to on-site sampling, a review of the facility, design and "as-built" diagrams and a discussion of work and occupancy practices occurred with staff.[33] The team lead, Joseph A. Cocciardi, PhD, MS, CSP, CIH, REHS/RS, developed material for school administrators and occupants to ensure they were aware of equipment, supplies and procedures used in the testing (human subject information). Notifications occurred (including maintenance and engineering staff), and building systems were operating per both instructions and as is typical to the school. This material was provided to the school administrator. This material is found appended at Appendix A. Once on-site, the investigation and testing team, which included a Certified Industrial Hygienist and an Environmental Technician performed the following:

- Inspected the air and occupancy characteristics of the test facility, including exterior stressors (e.g., traffic/surrounding occupancies). An inspection of the HVAC system occurred with building engineering staff.

- Refined the testing schedule to meet the assumptions stated.

- Reviewed the housekeeping plans and chemicals used to ensure they did not interfere with testing, and that they were being applied in a typical manner and per manufacturers recommendations (which they were).

- Refined the sampling and analysis plan which included 3 scenarios: typical occupancy with AP equipment off, typical occupancy with AP equipment ON, and varied environmental conditions with AP equipment operating as warranted.

- Accompanied the manufacturer who inspected units for placement and operability (per warranty), prior to sampling. On-site areas utilized for testing included classrooms, early childhood work rooms, a gymnasium, an auditorium, a clinic, a media center (electronic equipment in place and operating) and the innovation center on the site (multiple pieces of electrical equipment in operation), hallways and the exterior of the building.

The HVAC system, checked by the site engineer, was appropriately operating. This was reconfirmed during and subsequent to site testing.

Routine sanitation occurred in classrooms during periods while students were in other areas. Individual classroom schedules were provided to the sampling team prior to on-site activities. The sampling team reviewed these schedules and planned microbiological sampling to occur in timeframes that were

[33] As reported by ActivePure and Lamplighter, AP units were installed in the configuration that was tested on September 4, 2020 (some units had been previously in place; however, were upgraded to manufacturers recommendations for coverage at that time). They were used in concert with masking and hygiene/sanitation actions during the 2020-2021 school year. For that timeframe, and with both AP units working and personal safety measures, absenteeism was approximately one-half (½) the totals for the previous three (3) years. (During school years 2017 through 2020, Lamplighter averaged 4.72 absences per day. During school year 2020-2021, with the referenced protective measures in place, Lamplighter averaged 2.21 absences per day.)

unaffected by sanitation activities (i.e., sampling occurred prior to sanitation, up to 20 hours after cleaning with chemicals occurred).

Each subject area was sampled during normal business hours in accordance with the sampling plan.

ON-SITE ACTIVITIES

Based on the sampling plan developed for the site, and subsequent to site investigations and occupant notifications, sampling was performed on-site. The sampling procedures and/or site analysis procedures are described below. A brief discussion of exposure criteria is also included here. These activity notes are referenced in tables to follow.

A. **Carbon monoxide** concentrations were determined using a RAE Instruments Multirae Lite. This instrument was calibrated prior to use, with a 50 ppm carbon monoxide check gas mixture. The Limit of Detection (LOD) for this device is 1 ppm. A summary of results is identified in Tables 5, 17, and 26. **Temperature, relative humidity, and carbon dioxide** levels were measured using a TSI IAQ-Calc 7545. This instrument is factory calibrated, and was field tested with calibration gas before sampling.

   The adopted Exposure criteria for carbon monoxide is 9 ppm (NAAQS – public and sensitive group exposures). Any detectable CO in an indoor environment should be investigated and is of concern.

B. **Carbon Dioxide:** The OSHA Permissible Exposure Limit (PEL) for carbon dioxide is 5,000 parts per million based on an 8-hour Time Weighted Average. The NIOSH Recommended Exposure Limit (REL), based on a 10-hour Time Weighted Average, and ACGIH Threshold Limit Value (TLV), based on an 8-hour Time Weighted Average, are also identified as 5,000 parts per million. ASHRAE identifies carbon dioxide concentrations of 700 ppm greater than ambient conditions or 3X exterior levels as an index for expectable air quality (ASHRAE 62.1-2010). This concentration is based on comfort (odor) criteria related to bio-effluent and general biological contaminant buildup. An indoor air concentration of carbon dioxide in excess of this guideline is not indicative of an increased risk to human health. This level provides a general indicator of whether air exchanges in a given indoor space are sufficient to provide comfort to most people occupying that space. Carbon dioxide results are found in Tables 5, 17 and 26.

C. **Temperature:** No specific OSHA criteria is established for temperature. However, OSHA recommends temperature be maintained in the range of 68 to 76 degrees Fahrenheit (OSHA Technical Manual).[34] ASHRAE suggests (ASHRAE 55-2010) a range of 68-74.5 degrees Fahrenheit to maintain comfort for a majority of people. OSHA does not specifically address relative humidity; although, ASHRAE recommends maintaining indoor relative humidity below 65% (ASHRAE 62.1-2010). Relative humidity below 30% may contribute to occupant

[34] U.S. Department of Labor: Occupational Safety and Health Administration TED:00-015: Technical Manual; Washington, D.C.; current.

discomfort from dryness. Conversely, humidity in excess of 65% may support the growth and proliferation of microbial organisms. ASHRAE in their newest document (ASHRAE 55 -2021) has identified a 6-step approach to indoor air comfort zones. Temperature levels are found in Table 6, 18 and 27.

D. Airborne concentrations of Volatile Organic Compounds (VOCs) were measured using an RAE Instruments Multirae Lite with Photoionization Detector (PID) on-site. Prior to each use the PID was calibrated against a reference standard (100 ppm isobutylene for a 1:1 benzene response). This meter detects non-specific airborne contaminants with an ionization potential of less than or similar to 10.6 electron volts[35]. The LOD for this device is 1 ppm. A summary of results is identified in Tables 5, 17, and 26. VOC in the built environment above 1 ppm are not typical and should be investigated, according to the U.S. EPA.

E. Direct reading analysis for ozone was performed using the following methodology: measurements collected in the center of each room, using an Ohio Lumix nanO3 Ozone Monitor. The LOD for this device is 3.0 ppb. This instrument is factory calibrated. A summary of results is identified in Tables 7, 19, and 28. Ozone levels were compared to the NAAQS for sensitive populations, and these are 70 ppb for an 8-hour exposure.

F. Direct reading analysis for noise was performed using the following methodology: measurements recorded of a minimum and maximum decibel (dBA) value over the course of 2-minute intervals using a TSI Quest SoundPro DL Class 1 sound level meter. This instrument was calibrated on-site using a TSI Quest Acoustical AC-300 Calibrator. A summary of results is identified in Tables 8, 20, and 29. The U.S. EPA has published “nuisance noise levels”, which are cited in this work, of 55 dBA.

G. Direct reading analysis for ultraviolet (UV) light was performed using the following methodology: measurements collected at a distance of 1’ from each unit, using an ILT2400 UVGI-NB light meter. The LOD for this device is 50pA. This unit is factory calibrated. A summary of results is identified in Tables 9, 21, and 30. UV light hazards are characterized and calculated based on the frequency/energy of the light wave.

H. Direct reading analysis for Electromagnetic Frequency (EMF) levels, using magnetic fields as the indicator, was performed using the following methodology: measurements collected at a distance of 1’ away from each unit, using an MSI Magnetic Field Meter. The LOD for this device is .001 Gauss. This unit is factory calibrated. A summary of results is identified in Tables 10, 22, and 31. Reading of 1-10 mG in indoor areas are typical at these distances, although all exposures should be maintained as low as reasonably achievable (ALARA).

I. Direct reading analysis for general illumination was performed using the following methodology: measurements taken of light sources at various heights and locations using an Extech LT-40 LED light meter. This unit is factory calibrated. A summary of results is identified in Tables 11, 23, and 32 levels of 3-5 ft. candles are needed for safe human movement.

[35] RAE Instruments: Operator’s Manual.

J. VOC samples were collected using SKC Inc. Coconut Shell Charcoal tubes, part number 226-01. These samples were taken using a Gilian BDX II low-flow pump, calibrated using a Bios Defender 520 primary calibration device. Seven (7) samples were collected at locations throughout the school. One (1) field blank sample was analyzed for comparison. All VOC laboratory analysis for this project was completed via Gas Chromatograph protocol by EMSL Analytical, Inc. (EMSL). A summary of results is identified in Table 12. VOC levels which approach 1 ppm are considered untypical (total VOC).

K. Nuisance dust in air samples were collected using gravimetric pre-weighed 37 mm PVC cassettes. These samples were taken using a Gilian BDX II low-flow pump, calibrated using a Gilian Gilibrator 2 primary calibration device. Seven (7) samples were collected at locations throughout the school. Two (2) field blank samples were analyzed for comparison. All nuisance dust laboratory analysis for this project was completed via NIOSH 0500 protocol by EMSL. A summary of results is identified in Table 13. Nuisance dusts of > 5 mg/m^3 are indicative of poor air quality, however many hygienists apply a factor of 2 to this numerical value (2.5 mg/ m^3). Specific wood dusts which cause allergic airway reactions may have values much lower.

L. Titanium in air samples were collected using gravimetric pre-weighed 37 mm PVC cassettes. These samples were taken using a Gilian BDX II low-flow pump, calibrated using a Gilian Gilibrator 2 primary calibration device. Seven (7) samples were collected at locations throughout the school. Two (2) field blank samples were analyzed for comparison. All titanium laboratory analysis for this project was completed via NIOSH 7303 protocol by EMSL. A summary of results is identified in Table 14.

The exposure assessment protocol for TiO_2 is depicted in Figure 2.

M. Microbial testing was accomplished using sterile collection swabs. Six (6) samples were collected at locations throughout the school while the air purification units were operational. These six (6) samples were repeated with the air purification units deactivated as background samples for comparison purposes. All microbiological laboratory analysis for this project was completed by EMSL. Samples were taken over a known area and analyzed for colony forming units (CFU) per square inch. A summary of results is identified in Tables 16 and 25. CFU can be qualitatively used to determine if air/surface cleaning is occurring, when normalized for comparison purposes.

N. Hydroxyl radical testing was performed using Methylene Blue Test Strips. For each location, a wet test strip was extracted from the holding tube using tweezers and placed onto a piece of filter paper. The time was recorded for how long it took the white strip to turn its maximum shade of blue. In each location, a control strip was first tested for color comparison purposes. A summary of results is identified in Tables 15, 24, and 33. This protocol was developed and tested by Dr. Victoria Stanavitch, and the full protocol is appended.

TABLE 5 INDOOR AIR QUALITY UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021				
Room	**CO_2 ppm**	**CO ppm**	**VOC ppm**	**Time**
Early Childhood Workroom	905	0	0	09:05
Room 12	1,224	0	0	10:51
Room 20	605	0	0	10:14
Cook Gym	814	0	0	13:42
Kyle Warren Auditorium	731	0	0	11:12
Clinic	852	0	0	12:11
Media Center Office	1,288	0	0	13:16
Innovation Lab 41	688	0	0	15:56
Tutor Room	1,191	0	0	12:14
East Hall	1,162	0	0	13:04
Outside (Background)	460	0	0	16:05

See activity notes A and B above.

TABLE 6 TEMPERATURE AND RELATIVE HUMIDITY UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021			
Room	**Temperature (°F)**	**rH (%)**	**Time**
Early Childhood Workroom	70.0	49.5	09:00
Room 12	69.7	54.8	10:51
Room 20	70.2	51.5	10:14
Cook Gym	67.1	48.8	13:42
Kyle Warren Auditorium	69.7	62.6	11:31
Clinic	73.6	57.9	12:11
Media Center Office	72.5	55.7	13:16
Innovation Lab 41	71.4	48.4	15:56
Tutor Room	77.0	54.0	12:14
East Hall	71.1	56.6	13:04
Outside (Background)	74.2	57.1	16:05

See Activity note A above.

TABLE 7 OZONE LEVELS UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021		
Room	**Ozone (ppb)**	**Time**
Early Childhood Workroom	1.9	09:17
Room 12	6.8	10:49
Room 20	7.1	10:08
Cook Gym	4.0	13:42
Kyle Warren Auditorium	3.5	11:14
Clinic	3.6	12:04
Media Center Office	3.5	13:17
Innovation Lab 41	11.0	15:31
Tutor Room	5.4	12:15
East Hall	6.2	13:02

See activity note C above.

TABLE 8 NOISE LEVELS UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021			
Room	**Noise range (dBA)**	**Time**	**Occupied/Unoccupied**
Early Childhood Workroom	47.1-47.8	10:15	Occupied
Room 12	50.8-56.5	13:00	Unoccupied
Room 20	56.1-71.1	13:05	Occupied
Cook Gym	52.5-56.5	13:46	Occupied
Kyle Warren Auditorium	50.4-51.2	14:40	Occupied
Clinic	49.8-70.9	14:30	Occupied
Media Center Office	51.9-53.5	17:49	Unoccupied
Innovation Lab 41	55.7-57.1	16:01	Unoccupied
Tutor Room	56.1-56.6	17:11	Occupied
East Hall	54.3-55.7	17:37	Unoccupied

See activity note D above.

TABLE 9 ULTRAVIOLET LIGHT TESTING UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021		
Room	**UV Levels (A)**	**Time**
Early Childhood Workroom	5.717e-11, 4.440e-10	09:06
Room 12	2.550e-10	10:48
Room 20	6.982e-10, 1.908e-10, 1.143e-10	10:12
Cook Gym	6.128e-10, 6.525e-10, 2.027e-10, 4.508e-10, 8.155e-10	13:48
Kyle Warren Auditorium	5.073e-11, 8.191e-11, 4.691e-11, 2.880e-11, 4.675e-11	11:21
Clinic	1.35e-10	12:07
Media Center Office	3.653e-11	13:15
Innovation Lab 41	5.976e-12, 7.561e-11, 3.591e-13	15:54
Tutor Room	3.858-11	12:17
East Hall	4.456e-11	13:06

See activity note E above.

TABLE 10 EMF READINGS UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021		
Room	**EMF Readings (gauss)**	**Time**
Early Childhood Workroom	0.004, 0.000	08:44
Room 12	0.000	10:47
Room 20	0.001, 0.001, 0.015	10:10
Cook Gym	0.001, 0.004, 0.003, 0.002, 0.004	13:48
Kyle Warren Auditorium	0.002, 0.001, 0.009, 0.003, 0.002	11:17
Clinic	0.002	12:05
Media Center Office	0.024	13:13
Innovation Lab 41	0.001, 0.047, 0.011	15:53
Tutor Room	0.000	12:16
East Hall	0.002	13:59

See activity note F above.

TABLE 11 GENERAL ILLUMINATION UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021			
Room	**Illumination Results (fc)**	**Geometric Mean (fc)**	**Time**
Early Childhood Workroom	17.60, 19.00, 19.05	18.5	08:17
Room 12	19.24, 24.95, 43.36	27.5	10:50
Room 20	20.01, 22.22, 8.50	15.6	10:07
Cook Gym	68.63, 71.74, 100.50	79.1	13:42
Kyle Warren Auditorium	11.24, 5.37, 4.53, 8.84	7.0	11:24
Clinic	20.81, 8.94, 6.28	10.5	12:08
Media Center Office	21.51, 15.46, 17.08	17.8	13:14
Innovation Lab 41	31.20, 35.34, 13.18	24.4	16:03
Tutor Room	14.36, 14.54, 26.17	17.6	14:11
East Hall	1.75, 6.49, 4.70	3.8	13:07

See activity note G above.

TABLE 12 VOLATILE ORGANIC COMPOUNDS UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021								
Analyte	**EC Work-room**	**Room 20**	**Room 12**	**Clinic**	**Cook Gym**	**Tutor Room**	**East Hall**	**Field Blank**
Acetonitrile	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Methyl-t-butyl ether	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
2-Ethoxyethyl Acetate	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Acetone	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Benzene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Chlorobenzene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Chloroform	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Ethyl Acetate	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Ethyl Benzene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Isobutanol	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Isopropanol	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Methyl Ethyl Ketone	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Methylene chloride	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
n-Butyl Acetate	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
n-Hexane	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Styrene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Tetrachloroethene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Tetrahydrofuran	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Toluene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Trichloroethene	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL
Xylenes, Total	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL	<MRL

Table Notes: MRL: Method Reporting Limit

See Activity note H above.

TABLE 13 NUISANCE DUST UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021		
Room	**Reporting Limit (mg/m^3)**	**Result (mg/m^3)**
Early Childhood Workroom	0.41	<0.41
Room 12	0.38	<0.38
Room 20	0.47	<0.47
Cook Gym	0.49	<0.49
Clinic	0.41	<0.41
Tutor Room	0.35	<0.35
East Hall	0.47	<0.47
Field Blank	N/A	N/A
Field Blank	N/A	N/A

See activity note I above.

TABLE 14 TITANIUM IN AIR UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021		
Room	**Reporting Limit ($\mu g/m^3$)**	**Result ($\mu g/m^3$)**
Early Childhood Workroom	8.1	<8.1
Room 12	7.5	<7.5
Room 20	9.5	<9.5
Cook Gym	9.8	<9.8
Clinic	8.2	<8.2
Tutor Room	6.9	<6.9
East Hall	9.5	<9.5
Field Blank	1.0	<1.0
Field Blank	1.0	<1.0

See activity note J above.

TABLE 15 HYDROXYL RADICAL TESTING UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021			
Room	**Location**	**Test Duration**	**Time**
Early Childhood Workroom	Center Table	3:46	10:46
Room 12	Teacher's Desk	3:46	14:04
Room 20	Center Desk	3:14	11:20
Cook Gym	Center Floor	3:09	13:55
Kyle Warren Auditorium	Rear Table	6:44	14:57
Clinic	Nurse's Table	4:10	13:39
Media Center Office	Side Counter	3:57	17:56
Innovation Lab 41	Center Desk	4:04	16:00
Tutor Room	Center Desk	2:47	17:09
East Hall	Center Desk	4:22	17:44

See activity note L above.

TABLE 16 BACTERIAL PLATE COUNT UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 2, 2021			
Room	**Location**	**Time**	**Result (CFU/in^2)**
Early Childhood Workroom	Center Table	08:29	None Detected
Room 12	Center Desk	10:41	None Detected
Room 20	Center Desk	10:03	68
Cook Gym	Center Floor	13:39	7.5
Clinic	Nurse's Table	12:03	25
Innovation Lab 41	Center Desk	15:41	None Detected

See activity note K above.

TABLE 17 INDOOR AIR QUALITY UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021				
Room	**CO_2 ppm**	**CO ppm**	**VOC ppm**	**Time**
Early Childhood Workroom	681	0	0	08:46
Room 12	1,167	0	0	10:11
Room 20	1,018	0	0	09:19
Cook Gym	743	0	0	14:06
Kyle Warren Auditorium	966	0	0	11:57
Clinic	969	0	0	12:29
Innovation Lab 41	625	0	0	16:06
Outside (Background)	469	0	0	16:30

See activity notes A and B above.

TABLE 18 TEMPERATURE AND RELATIVE HUMIDITY UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021			
Room	**Temperature (ºF)**	**rH (%)**	**Time**
Early Childhood Workroom	67.0	60.9	08:46
Room 12	70.1	63.4	10:11
Room 20	70.0	69.4	09:19
Cook Gym	68.8	70.2	14:06
Kyle Warren Auditorium	69.5	71.8	11:57
Clinic	70.2	74.9	12:29
Innovation Lab 41	68.6	54.0	16:06
Outside (Background)	70.1	78.9	16:30

See activity note A above.

TABLE 19 OZONE LEVELS UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021		
Room	**Ozone (ppb)**	**Time**
Early Childhood Workroom	2.1	08:43
Room 12	3.4	10:03
Room 20	3.8	09:15
Cook Gym	5.1	13:52
Kyle Warren Auditorium	2.3	11:47
Clinic	3.2	12:26
Innovation Lab 41	7.6	15:51

See activity note C above.

TABLE 20 NOISE LEVELS UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021			
Room	**Noise range (dBA)**	**Time**	**Occupied/Unoccupied**
Early Childhood Workroom	40.9-44.3	08:50	Unoccupied
Room 12	40.1-52.2	10:18	Unoccupied
Room 20	46.1-60.0	09:24	Occupied
Cook Gym	44.7-45.5	14:11	Unoccupied
Kyle Warren Auditorium	42.8-47.0	11:53	Unoccupied
Clinic	49.0-67.1	12:37	Occupied
Innovation Lab 41	35.0-38.0	16:08	Unoccupied

See activity note D above.

TABLE 21 ULTRAVIOLET LIGHT TESTING UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021		
Room	**UV Levels (A)**	**Time**
Early Childhood Workroom	1.267e-10, 6.870e-11	08:44
Room 12	9.733e-11	10:09
Room 20	1.951e-11, 1.615e-10, 7.046e-11	09:17
Cook Gym	2.045e-10, 6.737e-11, 7.762e-11, 1.273e-10, 3.947e-10	14:04
Kyle Warren Auditorium	7.423e-12, 3.045e-11, 1.248e-11, 3.593e-11, 3.335e-12	11:55
Clinic	2.124e-09	12:25
Innovation Lab 41	7.109e-11, 1.743e-13, 9.528e-14	15:57

See activity note E above.

TABLE 22 EMF READINGS UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021		
Room	**EMF Readings (gauss)**	**Time**
Early Childhood Workroom	0.000, 0.000	08:41
Room 12	0.000	10:07
Room 20	0.000, 0.000, 0.000	09:14
Cook Gym	0.000, 0.000, 0.000, 0.000, 0.000	13:58
Kyle Warren Auditorium	0.000, 0.000, 0.000, 0.000, 0.004	11:49
Clinic	0.000	12:24
Innovation Lab 41	0.000, 0.000, 0.000	13:59

See activity note F above.

TABLE 23 GENERAL ILLUMINATION UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021			
Room	**Illumination Results (fc)**	**Geometric Mean (fc)**	**Time**
Early Childhood Workroom	18.36, 24.37, 19.21	20.5	08:43
Room 12	16.36, 38.13, 20.12	23.2	10:14
Room 20	20.61, 13.87, 5.41	11.6	09:21
Cook Gym	41.60, 34.42, 54.71	42.8	14:08
Kyle Warren Auditorium	16.10, 6.85, 6.10	8.8	11:59
Clinic	14.01, 51.28, 6.17	16.4	12:30
Innovation Lab 41	35.85, 23.14, 28.81	28.8	16:02

See activity note G above.

TABLE 24 HYDROXYL RADICAL TESTING UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021			
Room	**Location**	**Test Duration**	**Time**
Early Childhood Workroom	Center Table	5:32	09:03
Room 12	Center Desk	5:21	10:31
Room 20	Teacher's Desk	5:39	09:43
Cook Gym	Center Floor	6:23	14:20
Kyle Warren Auditorium	Rear Table	9:13	12:17
Clinic	Rear Counter	4:37	12:43
Innovation Lab 41	Center Desk	7:33	16:17
Outside (Background)	Sidewalk	9:20	13:41

See activity note L above.

TABLE 25 BACTERIAL PLATE COUNT UNITS OFF LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 3, 2021			
Room	**Location**	**Time**	**Result (CFU/in^2)**
Early Childhood Workroom	Center Table	08:55	None Detected
Room 12	Center Desk	09:59	140
Room 20	Center Desk	09:30	None Detected
Cook Gym	Center Floor	13:50	>13,000
Clinic	Sink Counter	12:22	None Detected
Innovation Lab 41	Center Desk	15:31	>13,000

See activity note K above.

TABLE 26 INDOOR AIR QUALITY CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021				
Room	**CO_2 ppm**	**CO ppm**	**VOC ppm**	**Time**
Innovation Lab 41	545	0	0	06:54
Innovation Lab 41	593	0	0	09:02
Innovation Lab 41	641	0	0	11:15
Innovation Lab 41	620	0	0	12:34
Innovation Lab 40 (Background)	557	0	0	11:34
Outside (Background)	471	0	0	11:39

See activity notes A and B above.

TABLE 27 TEMPERATURE AND RELATIVE HUMIDITY CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021			
Room	**Temperature (°F)**	**rH (%)**	**Time**
Innovation Lab 41	68.1	54.0	06:54
Innovation Lab 41	70.2	56.4	09:02
Innovation Lab 41	72.9	53.4	11:15
Innovation Lab 41	75.2	44.5	12:37
Innovation Lab 40 (Background)	71.5	48.8	11:34
Outside (Background)	79.5	79.5	11:39

See activity note A above.

TABLE 28 OZONE LEVELS CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021		
Room	**Ozone (ppb)**	**Time**
Innovation Lab 41	2.2	06:56
Innovation Lab 41	2.7	09:05
Innovation Lab 41	2.6	11:17
Innovation Lab 41	2.5	12:37

See activity note C above.

TABLE 29 NOISE LEVELS CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021			
Room	**Noise range (dBA)**	**Time**	**Occupied/Unoccupied**
Innovation Lab 41	55.7-56.3	07:09	Unoccupied
Innovation Lab 41	54.8-55.6	09:24	Unoccupied
Innovation Lab 41	53.7-54.2	11:24	Unoccupied
Innovation Lab 41	55.8-56.2	12:42	Unoccupied

See activity note D above.

TABLE 30 ULTRAVIOLET LIGHT TESTING CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021		
Room	**UV Levels (A)**	**Time**
Innovation Lab 41	7.567e-13, 4.037e-11, 1.317e-12	6:56
Innovation Lab 41	1.156e-11, 6.495e-11, 7.854e-12	9:08
Innovation Lab 41	2.386e-11, 5.546e-11, 1.598e-11	11:20
Innovation Lab 41	1.513e-11, 4.474e-11, 6.513e-12	12:39

See activity note E above.

TABLE 31 EMF READINGS CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021		
Room	**EMF Readings (gauss)**	**Time**
Innovation Lab 41	0.000, 0.096, 0.004	07:01
Innovation Lab 41	0.001, 0.091, 0.007	09:04
Innovation Lab 41	0.000, 0.124, 0.002	11:18
Innovation Lab 41	0.001, 0.075, 0.008	12:36

See activity note F above.

TABLE 32 GENERAL ILLUMINATION CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021			
Room	**Illumination Results (fc)**	**Geometric Mean (fc)**	**Time**
Innovation Lab 41	33.87, 22.71, 21.37	25.4	07:06
Innovation Lab 41	32.06, 31.52, 30.12	31.2	09:14
Innovation Lab 41	49.14, 40.03, 36.58	42.6	11:21
Innovation Lab 41	40.04, 43.65, 36.42	39.9	12:37

See activity note G above.

TABLE 33 HYDROXYL RADICAL TESTING CONTROLLED CLIMATE UNITS ON LAMPLIGHTER SCHOOL 11611 INWOOD ROAD DALLAS, TEXAS 75229 DECEMBER 4, 2021			
Room	**Location**	**Test Duration**	**Time**
Innovation Lab 41	Center Table	3:54	07:15
Innovation Lab 41	Center Table	4:01	09:19
Innovation Lab 41	Center Table	4:03	11:30
Innovation Lab 41	Center Table	3:59	12:52

See activity note L above.

It is important to note that the results of the surveys identified in this report are representative of the conditions that were present during sampling. It is possible that changes in atmospheric conditions, building usage, ventilation rates, etc., could affect these results.

RESULTS SUMMARY

Below are identified key findings for each parameter investigated:

- **Indoor Air Quality**: IAQ parameters were found to be typical to the school environment. Interior CO_2 levels were found to be less than X3 exterior in all cases – extensive on-site sampling was performed. CO_2 levels rose during the day and in comparison to non-occupied areas. (Note: This indicates both near-full occupancy [exhaled breathe = CO_2] and may indicate an inefficient HVAC system in SOME areas). Less than 1 ppm of VOC were identified through the school. Indoor air quality data was compared to the recommended levels published by ASHRAE and the U.S. EPA (National Ambient Air Quality Standards).
- **Temperature and rH**: During the testing, temperatures were found to be between 67 and 77 degrees, with rH below exterior levels. (Note: ASHRAE recommends a comfort zone of temperatures which now take into consideration multiple factors; however, the scale roughly mimics the temperature range found [no solar loads need be considered indoors, and wind speed is negligent]). The tests were indicative of all ranges recommended by ASHRAE as temperatures and rH were able to be varied by approximately 10˚F and 28% rH. ASHRAE comfort zone criteria were used for comparisons.
- **Ozone (O_3)**: Negligent levels of O_3 were identified upon test, and the levels of O_3 present were found to be similar (i.e., within 1.4 parts per billion) with AP equipment running and not running. Note: The National Ambient Air Quality Standards for O_3 are 70 ppb, and levels below 10 ppb were found in all cases. There is not an O_3 concern from this equipment. The NAAQS were used for comparison purposes.

- **Physical Noise**: Testing for sound pressure levels was performed during all testing, and in general, levels were found to be louder in occupied rooms versus unoccupied. In no cases were hazardous or dangerous noise or sound pressure levels found. Levels of 45-55 dBA are typically identified as a no nuisance level in varied occupancies, while levels of 70 dB over a lifetime are indicative of potential harm (U.S. EPA). Levels found were 47-56 dBA with equipment operating, 40-60 dBA without equipment operating and above 55 dBA in certain unoccupied rooms. (Note: The portion of sound pressure increased by AP equipment is negligible and does not add to nuisance or hazardous noise.) When compared to occupational noise and sound pressure standards, these levels are below any levels of concern.
- **Bacteria**: Sampling of surfaces occurred and were normalized by Colony Forming Units per square inch. In no cases did bacterial levels rise. With units off there were two (2) locations where bacterial levels were elevated by multiple orders of magnitude and a third where they were 140 CFU higher (significantly above non detected) in a classroom. It appears based on the quantities found in some of the samples that the AP units in concert with standard housekeeping, reduce bacteria by up to five (5) orders of magnitude.
- **UV LIGHT Spectrum Issues**: UV light ranges were tested both with and without the units operating, UV was in the 10E-10 to 10E-14 range, and in one case higher without the AP equipment running (other electrical equipment in the room was operating). There are no energy levels of concern.
- **General Light Spectral Levels:** The varied levels of light did not influence the results of tests or the levels of ·OH found.
- **Hydroxy-radical (·OH) Levels**: ·OH levels in all cases were found to be greater than levels with the units off. This was found through the varied temperature ranges, the varied light, sound pressure and rH conditions. Varying the environment did not change these findings. They matched the bacterial findings. Dust levels in air were found to be negligible. This testing identified that if units are maintained and used as directed, they will produce the expected effect and reduce bacteria. (Of note: There is not a fully recognized test for ·OH in air. The testing procedure, which has undergone peer review, is awaiting collegial publication.)
- **EMF**: Equipment which utilizes electricity creates both an electric and a magnetic field, potentially carcinogenic (as identified by EPA/WHO) and subsequently Recommended Exposure Levels are ALARA. While some states regulate these devices in “child intended”, equipment must follow recommendations of the professional bodies. California has removed exposure levels (numerical) and utilizes the ALARA concept. Site testing was completed with calibrated equipment, and most levels hovered around the 1-5 mGauss level, which is average for homes in the United States. The outlier was the Innovation Lab, which had a good amount of electrical equipment. These levels meet the ALARA standard. There is no EMF concern generated with AP equipment.
- **DUSTS**: Dusts were collected and measured for both ambient purposes as well as to determine the composition of the dusts (See TiO_2 comment below). In all cases (with equipment running) dusts were below detectable levels, and less than a mg. The equipment does not increase ambient dust levels however, it also maintains levels as non-detectable or reduces ambient dust levels.
- **Titanium Dioxide**: TiO_2 now considered carcinogenic by many scientific bodies was collected and measured. The recommended procedure for collection and analysis was followed (this is a 3-step analysis process). In all cases TiO_2 levels were found to be below levels of concern (While some particulate matter was identified, it was not found to meet the criteria for analysis for TiO_2, based on the best science available.) There is not a TiO_2 concern from AP equipment based on the levels found.

CONCLUSIONS

It is reasonable to conclude that: If used according to manufacturer's recommendations and in combination with an appropriate cleaning program, the tested devices (AP) will safely and continuously eliminate viral particles in air, reduce bacterial loads and minimize other ambient dusts.

RECOMMENDATIONS

AP may wish to consider additional testing to verify the conclusion stated above if:

i) The equipment is used outside of parameters recommended by the manufacturer.
ii) ·OH quantitative testing is validated for field use.

CERTIFICATION

The information contained in this report is believed to be accurate and true to the best knowledge of the inspector(s). Findings and recommendations for this investigation are based on the observations of the conditions, as they existed at that time. The inspector(s) and Pennoni assumes no liability for financial or health consequences due to actions or lack of actions taken by the client as a result of this investigation.

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APPENDIX A

Fact Sheet

APPENDIX B

Sampling Laboratory Reports and Associated Chains of Custody

APPENDIX C

HVAC Information

APPENDIX D

Campus Map

APPENDIX E

Hydroxyl Radical Testing Protocol

APPENDIX A

Fact Sheet

Background: The Lamplighter School has purchased air cleaning equipment from the ACTIVEPURE Technologies LLC and has installed this portable equipment in various classrooms and areas. ACTIVEPURE performs routine testing of their equipment to ensure safety and efficacy and has requested access to areas of the school to perform these tests, which should occur in mid-November. Testing is performed under the direction and supervision of an independent Scientific Review Board consisting of a medical doctor, an engineer, a biologist and an Industrial Hygienist. Frequent questions (FAQ) are found below:

WHAT TYPE OF TEST ARE BEING PERFORMED?
Two types of tests will be performed, tests to ensure byproducts of the air cleaning equipment are in safe ranges and tests to ensure the equipment efficacy. Safety testing equipment consists of small "pumps" which breathe as we do, and appropriate collection media over which air is drawn. The media is analyzed at an independent lab. The equipment is pictured. Air is collected at floor level and in breathing zone ranges (3-6 feet). Efficiency testing equipment consists of small "plates" to both collect air cleaning emissions and ensure it will clean viral/bacterial particles.

ARE THERE ANY DANGEROUS CHEMICAL USED IN THE TESTS ?
No, filter media consists of charcoal and coconut shell grindings and is completely enclosed. Viral/ bacterial tests use surrogates, NOT live agents. Air temperature and moisture content, as well as equipment noise levels is also checked.

WILL WE HAVE ACCESS TO THE TEST RESULTS?
Yes, once the scientific review panel provides ActivePure with test results ActivePure has assured us that they will rapidly provide summaries and reports. This will be 14-28 days after tests are collected.

CAN WE HAVE ACCESS TO THE ACTIVEPURE SCIENTIFIC REVIEW PERSONNEL – TO ASK QUESTIONS ABOUT THE TESTS OR RESULTS ?
Yes, we can collect questions in both areas and provide them to the panel directly for answers, which will come directly back to us as well as ActivePure.

FOR ADDITIONAL INFORMATION NOW – **CONTACT MARYNELL MURPHY AT** _____.

This FACT SHEET was prepared by Joseph Cocciardi, PhD, CIH, CSP, REHS/RS, Chair of the ActivePure device scientific review panel (10/18/2021).

APPENDIX B

Sampling Laboratory Reports and Associated Chains of Custody

EMSL Analytical, Inc.
3410 Winnetka Avenue North
New Hope, MN 55427
(763) 449-4922

Joe Cocciardi
Pennoni Associates
4 Kacey Court
Mechanicsburg, PA 17055

December 20, 2021
Report #: 2101019

RE: APURE21001

Dear Joe Cocciardi:

EMSL Analytical, Inc. received samples for the project identified above on December 13, 2021. All samples were received in acceptable condition and analyzed in the EMSL Analytical, Inc. laboratory unless otherwise noted. Analytical results are summarized in the following report. These results are not method blank or field blank corrected unless otherwise indicated. All routine quality assurance procedures were followed and all quality control acceptance criteria were met, unless otherwise noted.

EMSL Analytical, Inc. (ID 101103) is an EPA-recognized NLLAP laboratory based on its accreditation by the AIHA Laboratory Accreditation Programs, LLC (AIHA-LAP, LLC) in the Environmental Lead and Industrial Hygiene laboratory accreditation programs as documented by the Scope of Accreditation Certificate and associated Scope.

Where possible, the samples will be retained by the laboratory for 60 days following issuance of the initial final report. The samples will be disposed of or returned at that time. Arrangements can be made for extended storage by contacting me at this time.

We appreciate your decision to use EMSL Analytical, Inc. for this project. We are committed to being your vendor of choice to meet your analytical chemistry needs.

If you have any questions please contact me at the above phone number.

Sincerely,

Mark Erickson
Project Manager

EMSL Analytical, Inc.
3410 Winnetka Avenue North
New Hope, MN 55427
(763) 449-4922

Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Qualifiers and Abbreviations

COC	Chain of Custody
MRL	Method Reporting Limit
ppm	Parts per million in Air
NA	Not Applicable
NR	Not Reported
%Rec	Percent Recovery
RPD	Relative Percent Difference

EMSL Analytical, Inc.
3410 Winnetka Avenue North
New Hope, MN 55427
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Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Sample Summary

Sample ID	Laboratory ID	Matrix	Area, Air Volume or Time Sampled	Date Sampled	Date Received
9510167135 - Early Childhood Workroom	2101019-01	Air Tube	3.66 Liters	12/02/21 10:03	12/13/21 09:35
9510167139 - Room 20	2101019-02	Air Tube	2.925 Liters	12/02/21 12:10	12/13/21 09:35
9510168225 - Room 12	2101019-03	Air Tube	3.0 Liters	12/02/21 13:18	12/13/21 09:35
9510167140 - Clinic	2101019-04	Air Tube	2.241 Liters	12/02/21 14:26	12/13/21 09:35
9510167131 - Cook Gym	2101019-05	Air Tube	2.963 Liters	12/02/21 16:05	12/13/21 09:35
9510168225 - Tutor Room	2101019-06	Air Tube	2.982 Liters	12/02/21 16:22	12/13/21 09:35
9510167137 - East Hall	2101019-07	Air Tube	2.905 Liters	12/02/21 18:29	12/13/21 09:35
9510168222	2101019-08	Air Tube	NA	12/02/21 00:00	12/13/21 09:35

EMSL Analytical, Inc.
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Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
EMSL Analytical, Inc.									
2101019-01 9510167135 - Early Childhood Workroom (Air Tube)									
Acetonitrile	< 0.559	0.559	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 0.227	0.227	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 0.187	0.187	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 2.21	2.21	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 0.127	0.127	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 0.182	0.182	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.168	0.168	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.247	0.247	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.185	0.185	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 1.55	1.55	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 1.99	1.99	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.312	0.312	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.231	0.231	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.174	0.174	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.452	0.452	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 1.25	1.25	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.120	0.120	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.284	0.284	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.220	0.220	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.153	0.153	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.566	0.566	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-02 9510167139 - Room 20 (Air Tube)									

EMSL Analytical, Inc.
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Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-02 9510167139 - Room 20 (Air Tube)									
Acetonitrile	< 0.700	0.700	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 0.284	0.284	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 0.234	0.234	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 2.77	2.77	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 0.159	0.159	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 0.227	0.227	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.210	0.210	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.309	0.309	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.232	0.232	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 1.94	1.94	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 2.48	2.48	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.391	0.391	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.289	0.289	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.218	0.218	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.565	0.565	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 1.56	1.56	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.150	0.150	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.355	0.355	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.275	0.275	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.191	0.191	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.709	0.709	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-03 9510168225 - Room 12 (Air Tube)									
Acetonitrile	< 0.682	0.682	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

EMSL Analytical, Inc.
3410 Winnetka Avenue North
New Hope, MN 55427
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Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-03 9510168225 - Room 12 (Air Tube)									
Methyl-t-butyl ether	< 0.277	0.277	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 0.228	0.228	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 2.70	2.70	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 0.155	0.155	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 0.222	0.222	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.205	0.205	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.302	0.302	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.226	0.226	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 1.90	1.90	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 2.42	2.42	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.381	0.381	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.282	0.282	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.213	0.213	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.551	0.551	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 1.52	1.52	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.146	0.146	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.346	0.346	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.268	0.268	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.186	0.186	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.691	0.691	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-04 9510167140 - Clinic (Air Tube)									
Acetonitrile	< 0.913	0.913	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 0.371	0.371	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

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Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-04 9510167140 - Clinic (Air Tube)									
2-Ethoxyethyl Acetate	< 0.306	0.306	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 3.61	3.61	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 0.207	0.207	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 0.297	0.297	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.274	0.274	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.404	0.404	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.302	0.302	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 2.54	2.54	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 3.24	3.24	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.510	0.510	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.378	0.378	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.285	0.285	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.738	0.738	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 2.04	2.04	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.195	0.195	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.463	0.463	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.359	0.359	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.249	0.249	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.925	0.925	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-05 9510167131 - Cook Gym (Air Tube)									
Acetonitrile	< 0.691	0.691	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 0.281	0.281	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 0.231	0.231	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

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4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-05 9510167131 - Cook Gym (Air Tube)									
Acetone	< 2.73	2.73	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 0.157	0.157	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 0.224	0.224	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.207	0.207	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.305	0.305	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.229	0.229	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 1.92	1.92	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 2.45	2.45	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.386	0.386	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.286	0.286	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.215	0.215	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.558	0.558	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 1.54	1.54	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.148	0.148	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.350	0.350	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.271	0.271	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.188	0.188	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.700	0.700	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-06 9510168225 - Tutor Room (Air Tube)									
Acetonitrile	< 0.686	0.686	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 0.279	0.279	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 0.230	0.230	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 2.72	2.72	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

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4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-06 9510168225 - Tutor Room (Air Tube)									
Benzene	< 0.156	0.156	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 0.223	0.223	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.206	0.206	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.303	0.303	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.227	0.227	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 1.91	1.91	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 2.44	2.44	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.383	0.383	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.284	0.284	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.214	0.214	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.554	0.554	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 1.53	1.53	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.147	0.147	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.348	0.348	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.270	0.270	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.187	0.187	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.695	0.695	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-07 9510167137 - East Hall (Air Tube)									
Acetonitrile	< 0.705	0.705	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 0.286	0.286	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 0.236	0.236	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 2.79	2.79	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 0.160	0.160	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

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Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-07 9510167137 - East Hall (Air Tube)									
Chlorobenzene	< 0.229	0.229	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chloroform	< 0.212	0.212	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 0.312	0.312	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 0.233	0.233	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 1.96	1.96	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 2.50	2.50	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 0.393	0.393	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 0.291	0.291	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 0.220	0.220	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 0.569	0.569	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 1.57	1.57	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 0.151	0.151	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 0.357	0.357	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 0.277	0.277	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 0.192	0.192	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 0.714	0.714	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2101019-08 9510168222 (Air Tube)									
Acetonitrile	< 3.44	3.44	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl-t-butyl ether	< 6.00	6.00	ppm	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
2-Ethoxyethyl Acetate	< 3.70	3.70	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Acetone	< 19.2	19.2	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Benzene	< 1.49	1.49	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Chlorobenzene	< 3.06	3.06	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

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Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

Analyte	Result	MRL	Units	Dilution	Prepared	Analyzed	Analyst	Method	Notes
2101019-08 9510168222 (Air Tube)									
Chloroform	< 3.00	3.00	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Acetate	< 3.26	3.26	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Ethyl Benzene	< 2.94	2.94	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isobutanol	< 17.2	17.2	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Isopropanol	< 17.9	17.9	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methyl Ethyl Ketone	< 3.37	3.37	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Methylene chloride	< 2.94	2.94	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Butyl Acetate	< 3.03	3.03	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
n-Hexane	< 5.83	5.83	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Styrene	< 19.5	19.5	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrachloroethene	< 2.97	2.97	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Tetrahydrofuran	< 3.06	3.06	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Toluene	< 3.03	3.03	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Trichloroethene	< 3.00	3.00	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	
Xylenes, Total	< 9.00	9.00	ug/tube	1	12/15/21	12/16/21	MDE	VOCs by GC R1	

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Pennoni Associates	Client Ref: APURE21001	Report #: 2101019
4 Kacey Court	Client Contact: Joe Cocciardi	Project Mgr: Mark Erickson
Mechanicsburg, PA 17055	PO Number: NA	Account ID: PENA75

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Industrial Hygiene - Chain of Custody

EMSL Order Number / Lab Use Only: 2101019 / 352112037

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: c@emsl.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information

Customer ID:	PENA75
Company Name:	Pennoni Associates
Contact Name:	Joe Cocciardi
Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055
Country:	USA
Phone:	717-516-7437
Email(s) for Report:	jcocciardi@pennoni.com, mpotts@pennoni.com, nvasquez@pennoni.com

Billing Information

Billing ID:	PENA75
Company Name:	Pennoni Associates
Billing Contact:	Joe Cocciardi
Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055
Country:	USA
Phone:	717-516-7437
Email(s) for Invoice:	jcocciardi@pennoni.com

Project Name/No: APURE21001
Purchase Order:
EMSL LIMS Project ID: (If applicable, EMSL will provide)
US State where samples collected: TX
State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)
Media Type: Sorbent Tubes
Media Manufacturer/ Part Number: 226-01
Media Lot Number: 2000
Sampled By Name: Michael Potts
Sampled By Signature: Michael Potts
No. Samples in Shipment: 8

Turnaround Time (TAT) Options - Please check: (If no selection made, Standard 2 Week (EOD) TAT will apply)
☐ 2 Week ☐ 1 Week ☑ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☐ Other (Call Lab)

Client Sample ID	Location/Description	Analyte/ Method	Media	Flow (lpm)	Sample Time On	Sample Time Off	Volume/Area	Sample Type	Sample Date	Comments
9510167135	Early Childhood Workroom	NIOSH 2549	sorbent tube	0.047	0845	1003	3.66	☒ Area ☐ Personal	12/2/21	
9510167139	Room 20	NIOSH 2549	sorbent tube	0.045	1105	1210	2.925	☒ Area ☐ Personal		
9510168224	Room 12	NIOSH 2549	sorbent tube	0.05	1218	1318	3.0	☒ Area ☐ Personal		
9510167140	Clinic	NIOSH 2549	sorbent tube	.0415	1332	1426	2.241	☒ Area ☐ Personal		
9510167131	Cook Gym	NISOH 2549	sorbent tube	.0395	1445	1605	2.963	☒ Area ☐ Personal		
9510168225	Tutor Room	NIOSH 2549	sorbent tube	.0445	1515	1622	2.982	☒ Area ☐ Personal		
9510167137	East Hall	NIOSH 2549	sorbent tube	.0421	1720	1829	2.905	☒ Area ☐ Personal		
9510168222	Blank	NIOSH 2549	sorbent tube	N/A	N/A	N/A	N/A	☒ Area ☐ Personal		

RECEIVED EMSL CINNAMINSON, NJ 21 DEC -7 AM 11:15

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)
VOC analysis

Method of Shipment: FedEx
Sample Condition Upon Receipt:

Relinquished by: Michael Potts — Date/Time: 12/6/21 1700 — Received by: — Date/Time: 12/7/2021 10:00
Relinquished by: — Date/Time: 12/10/2021 — Received by: — Date/Time: 12/13/21 9:35

Controlled Document - COC-2 | Industrial Hygiene | R4 | 5/12/2021

☐ AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

(8)

Page 1 of 1

F.E. 283782456981

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. The report reflects the samples as received. When the information supplied by the customer can affect the validity of the data it will be noted on the report.

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Industrial Hygiene - Chain of Custody

EMSL Order Number / Lab Use Only: 210119 / 352112037

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: c@emsl.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information		Billing Information	
Customer ID:	PENA75	Billing ID:	PENA75
Company Name:	Pennoni Associates	Company Name:	Pennoni Associates
Contact Name:	Joe Cocciardi	Billing Contact:	Joe Cocciardi
Street Address:	4 Kacey Court	Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055	City, State, Zip:	Mechanicsburg, PA 17055
Country:	USA	Country:	USA
Phone:	717-516-7437	Phone:	717-516-7437
Email(s) for Report:	jcocciardi@pennoni.com, mpotts@pennoni.com, nvasquez@pennoni.com	Email(s) for Invoice:	jcocciardi@pennoni.com

Project Name/No: APURE21001 | Purchase Order:

EMSL LIMS Project ID: (If applicable, EMSL will provide) | US State where samples collected: TX | State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)

Media Type: Sorbent Tubes | Media Manufacturer/ Part Number: 226-01 | Media Lot Number: 2000

Sampled By Name: Michael Potts | Sampled By Signature: Michael Potts | No. Samples in Shipment: 8

Turnaround Time (TAT) Options - Please check: (If no selection made, Standard 2 Week (EOD) TAT will apply)
☐ 2 Week ☐ 1 Week ☑ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☐ Other (Call Lab)

Client Sample ID	Location/Description	Analyte/ Method	Media	Flow (lpm)	Sample Time On	Sample Time Off	Volume/Area	Sample Type	Sample Date	Comments
9510167135	Early Childhood Workroom	NIOSH 2549	sorbent tube	0.047	0845	1003	3.66	☒ Area ☐ Personal	12/2/21	
9510167139	Room 20	NIOSH 2549	sorbent tube	0.045	1105	1210	2.925	☒ Area ☐ Personal		
9510168224	Room 12	NIOSH 2549	sorbent tube	0.05	1218	1318	3.0	☒ Area ☐ Personal		
9510167140	Clinic	NIOSH 2549	sorbent tube	.0415	1332	1426	2.241	☒ Area ☐ Personal		
9510167131	Cook Gym	NISOH 2549	sorbent tube	.0395	1445	1605	2.963	☒ Area ☐ Personal		
9510168225	Tutor Room	NIOSH 2549	sorbent tube	.0445	1515	1622	2.982	☒ Area ☐ Personal		
9510167137	East Hall	NIOSH 2549	sorbent tube	.0421	1720	1829	2.905	☒ Area ☐ Personal		
9510168222	Blank	NIOSH 2549	sorbent tube	N/A	N/A	N/A	N/A	☒ Area ☐ Personal		

RECEIVED EMSL CINNAMINSON, NJ 21 DEC -7 AM 11:15

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)
VOC analysis

Method of Shipment: FedEx | Sample Condition Upon Receipt:

Relinquished by: Michael Potts | Date/Time: 12/6/21 1700 | Received by: | Date/Time 12/7/2021 10:00

Relinquished by: | Date/Time: 12/10/2021 | Received by: | Date/Time 12/13/21 9:35

Controlled Document - COC-2 Industrial Hygiene R4 05/12/2021

☐ AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

8

F.E. 283782456981

Page 1 of 1

OrderID: 352112037

EMSL Analytical - Industrial Hygiene
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 /
http://www.EMSL.com IndustrialHygienelab@emsl.com

EMSL Order:	282103464
CustomerID:	PENA75
CustomerPO:	
ProjectID:	

Attn: **Joe Cocciardi**
Pennoni Associates
4 Kacey Court
Mechanicsburg, PA 17055

Phone:	(717) 975-6481
Fax:	(717) 975-6480
Received:	12/07/21 10:00 AM
Analysis Date:	12/9/2021
Collected:	

Project: **APURE21001**

Test Report: Total Dust by NIOSH 0500

Sample	*Location*	*Volume (L)*	*Sample Weight (mg)*	*Concentration (mg/m³)*	*Reporting Limit (mg/m³)*	*Notes*
LL-TIO1-01 *282103464-0001*	Early Childhood Workroom	123.36	<0.050	<0.41	0.41	
LL-TIO2-01 *282103464-0002*	Room 20	105.37	<0.050	<0.47	0.47	
LL-TIO3-01 *282103464-0003*	Room 12	132.87	<0.050	<0.38	0.38	
LL-TIO4-01 *282103464-0004*	Clinic	122.5	<0.050	<0.41	0.41	
LL-TIO5-01 *282103464-0005*	Cook Gym	101.89	<0.050	<0.49	0.49	
LL-TIO6-01 *282103464-0006*	Tutor Room	144.13	<0.050	<0.35	0.35	
LL-TIO7-01 *282103464-0007*	East Hallway	105.798	<0.050	<0.47	0.47	
LL-Blank-01-01 *282103464-0008*	Blank		<0.050	N/A	N\A	Field Blank
LL-Blank-01-02 *282103464-0009*	Blank		<0.050	N/A	N\A	Field Blank

Notes: Discernable field blank submitted with samples.
Results are not field blank corrected.

Analyst(s)

Katelynn Sweeney (9)

Scott Van Etten, CIH, Laboratory Manager
or other approved signatory

Initial report from 12/09/2021 10:41:48

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Industrial Hygiene - Chain of Custody

EMSL Order Number / Lab Use Only: 282103464

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: c@emsl.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information		Billing Information	
Customer ID:	PENA75	Billing ID:	PENA75
Company Name:	Pennoni Associates	Company Name:	Pennoni Associates
Contact Name:	Joe Cocciardi	Billing Contact:	Pennoni Associates
Street Address:	4 Kacey Court	Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055	City, State, Zip:	Mechanicsburg, PA 17055
Country:	USA	Country:	USA
Phone:	717-516-7437	Phone:	717-516-7437
Email(s) for Report:	jcocciardi@pennoni.com, mpotts@pennoni.com, nvasquez@pennnoni.com	Email(s) for Invoice:	jcocciardi@pennoni.com

Project Name/No: APURE21001 | Purchase Order:

EMSL LIMS Project ID: (If applicable, EMSL will provide) | US State where samples collected: TX | State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)

Media Type: Cassette | Media Manufacturer/ Part Number: | Media Lot Number:

Sampled By Name: Michael Potts | Sampled By Signature: | No. Samples in Shipment: 18

Turnaround Time (TAT) Options - Please check: (If no selection made, Standard 2 Week (EOD) TAT will apply)
☐ 2 Week ☐ 1 Week ☐ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☒ Other (Call Lab)

	Client Sample ID	Location/Description	Analyte/ Method	Media	Flow (lpm)	Sample Time On	Sample Time Off	Volume/Area	Sample Type	Sample Date	Comments
1	LL-TIO1-01	Early Childhood Workroom		PVC Cassette	2.57	0837	0925	123.36 L	☒ Area ☐ Personal	12/2/21	Hold at lab
2	LL-TIO2-01	Room 20		PVC Cassette	2.57	1110	1151	105.37 L	☒ Area ☐ Personal	12/2/21	
3	LL-TIO3-01	Room 12		PVC Cassette	2.507	1202	1255	132.87 L	☒ Area ☐ Personal	12/2/21	
4	LL-TIO4-01	Clinic		PVC Cassette	2.5	1334	1423	122.5 L	☒ Area ☐ Personal	12/2/21	
5	LL-TIO5-01	Cook Gym		PVC Cassette	2.485	1448	1529	101.89 L	☒ Area ☐ Personal	12/2/21	
6	LL-TIO6-01	Tutor Room		PVC Cassette	2.485	1519	1617	144.13 L	☒ Area ☐ Personal	12/2/21	
7	LL-TIO7-01	East Hallway		PVC Cassette	2.519	1730	1812	105.798 L	☒ Area ☐ Personal	12/2/21	
8	LL-TIO1-02	Early Childhood Workroom		MCE Cassette	2.505	0837	0925	120.24 L	☒ Area ☐ Personal	12/2/21	

RECEIVED EMSL CINNAMINSON, NJ 21 DEC -7 AM 11:14

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)
Please hold at lab pending further instructions.

Method of Shipment: Fedex | Sample Condition Upon Receipt:

Relinquished by: Michael Potts | Date/Time: 12/6/21 1700 | Received by: | Date/Time: 12/7/2021 0100

Relinquished by: | Date/Time: | Received by: | Date/Time

Controlled Document - COC-21 Industrial Hygiene R4 05/12/2021

☐ **AGREE TO ELECTRONIC SIGNATURE** (By checking, I consent to signing this Chain of Custody document by electronic signature.)

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(18)

OrderID: 282103464

EMSL ANALYTICAL, INC.
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Industrial Hygiene - Chain of Custody

EMSL Order Number / Lab Use Only: 282103464

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: c@emsl.com

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

	Client Sample ID	Location/Description	Analyte/ Method	Media	Flow (lpm)	Sample Time On	Sample Time Off	Volume/Area	Sample Type	Sample Date	Comments
9	LL-TIO2-02	Room 20		MCE Cassette	2.509	1110	1151	102.869 L	☒ Area ☐ Personal	12/2/21	Hold at lab
10	LL-TIO3-02	Room 12		MCE Cassette	2.528	1202	1255	133.984 L	☒ Area ☐ Personal	12/2/21	
11	LL-TIO4-02	Clinic		MCE Cassette	2.52	1334	1423	123.48 L	☒ Area ☐ Personal	12/2/21	
12	LL-TIO5-02	Cook Gym		MCE Cassette	2.506	1448	1529	102.746 L	☒ Area ☐ Personal	12/2/21	
13	LL-TIO6-02	Tutor Room		MCE Cassette	2.48	1519	1617	143.84 L	☒ Area ☐ Personal	12/2/21	
14	LL-TIO7-02	East Hallway		MCE Cassette	2.489	1730	1812	104.538 L	☒ Area ☐ Personal	12/2/21	
15	LL-Blank-01-01	Blank		PVC Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
16	LL-Blank-01-02	Blank		PVC Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
17	LL-Blank-02-01	Blank		MCE Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
18	LL-Blank-02-02	Blank		MCE Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		

RECEIVED
EMSL
CINNAMINSON, NJ
21 DEC -7 AM 11:14

Method of Shipment: FedEx		Sample Condition Upon Receipt:	
Relinquished by: Michael Potts	Date/Time: 12/6/21 1700	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-21 Industrial Hygiene R4 05/12/2021

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OrderID: 282103464

Pitt, John

From: Joseph Cocciardi <JCocciardi@Pennoni.com>
Sent: Wednesday, December 08, 2021 5:08 PM
To: Passero, John S.; Pitt, John; Michael Potts; Vince Daliessio
Cc: Mirica, Eugenia; Bish, Jeromy
Subject: RE: Filter Testing - Pennoni -- 282103464

[EXTERNAL E-MAIL]

John – please do the 3 day TAT – and let me know when completed and we can go from there ! Thanks – I will sign and get this back to you when I get into the office in the morning – but please do log in and move forward. Thanks all, JOE C

Joseph Cocciardi, PhD, MS, CIH, CSP, REHS/RS

Pennoni
4 Kacey Court | Mechanicsburg, PA 17055
Direct: +1 (717) 516-7437 | **Mobile:** +1 (717) 215-5676
www.pennoni.com | JCocciardi@Pennoni.com

From: Passero, John S. <jpassero@EMSL.com>
Sent: Wednesday, December 8, 2021 4:59 PM
To: Pitt, John <jpitt@EMSL.com>; Joseph Cocciardi <JCocciardi@Pennoni.com>; Michael Potts <MPotts@Pennoni.com>; Vince Daliessio <VDaliessio@Pennoni.com>
Cc: Mirica, Eugenia <EMirica@EMSL.com>; Bish, Jeromy <jbish@EMSL.com>
Subject: RE: Filter Testing - Pennoni -- 282103464

Joe/Mike,

Please disregard the first quote I sent to you in a separate email. Attached is an updated quote with expedited turnaround times for NIOSH 0500 testing. Please let us know which turnaround time you need.

John

John S. Passero | *Materials Science Business and Account Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-858-4800 x3604 Cell: 609-313-0730 | Fax: | Toll Free: 800-220-3675

EMSL Analytical, Inc.
6340 CastlePlace Dr., Indianapolis, IN 46250
Phone: (317) 803-2997 Fax: (317) 803-3047 Email: indianapolislab@emsl.com

Attn: **Joe Cocciardi** 12/16/2021
Pennoni Associates
4 Kacey Court
Mechanicsburg, PA 17055
Phone: (717) 975-6481
Fax: (717) 975-6480

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 12/13/2021. The results are tabulated on the attached data pages for the following client designated project:

APURE21001

The reference number for these samples is EMSL Order #162129088. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (317) 803-2997.

Approved By:

Aleksandrea Kuchenbrod

Aleksandrea Kuchenbrod, Inorganic Chemisry Lab Manager

EMSL Analytical, Inc.
6340 CastlePlace Dr., Indianapolis, IN 46250
Phone/Fax: (317) 803-2997 / (317) 803-3047
http://www.EMSL.com indianapolislab@emsl.com

EMSL Order: 162129088
CustomerID: PENA75
CustomerPO:
ProjectID:

Attn: **Joe Cocciardi**
Pennoni Associates
4 Kacey Court
Mechanicsburg, PA 17055

Phone: (717) 975-6481
Fax: (717) 975-6480
Received: 12/13/2021 09:50 AM
Collected: 12/2/2021

Project: **APURE21001**

Analytical Results

Client Sample Description LL-TIO1-01 Early Childhood Workroom ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0001*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*	*Analysis Date & Analyst*
METALS						
NIOSH 7303	Titanium	<8.1	8.1	µg/m³	12/16/2021 WF	12/16/2021 WF

Client Sample Description LL-TIO2-01 Room 20 ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0002*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*	*Analysis Date & Analyst*
METALS						
NIOSH 7303	Titanium	<9.5	9.5	µg/m³	12/16/2021 WF	12/16/2021 WF

Client Sample Description LL-TIO3-01 Room 12 ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0003*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*	*Analysis Date & Analyst*
METALS						
NIOSH 7303	Titanium	<7.5	7.5	µg/m³	12/16/2021 WF	12/16/2021 WF

Client Sample Description LL-TIO4-01 Clinic ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0004*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*	*Analysis Date & Analyst*
METALS						
NIOSH 7303	Titanium	<8.2	8.2	µg/m³	12/16/2021 WF	12/16/2021 WF

Client Sample Description LL-TIO5-01 Cook Gym ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0005*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*	*Analysis Date & Analyst*
METALS						
NIOSH 7303	Titanium	<9.8	9.8	µg/m³	12/16/2021 WF	12/16/2021 WF

Client Sample Description LL-TIO6-1 Tutor Room ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0006*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*	*Analysis Date & Analyst*
METALS						

EMSL Analytical, Inc.
6340 CastlePlace Dr., Indianapolis, IN 46250
Phone/Fax: (317) 803-2997 / (317) 803-3047
http://www.EMSL.com indianapolislab@emsl.com

EMSL Order: 162129088
CustomerID: PENA75
CustomerPO:
ProjectID:

Attn: **Joe Cocciardi**
Pennoni Associates
4 Kacey Court
Mechanicsburg, PA 17055

Phone: (717) 975-6481
Fax: (717) 975-6480
Received: 12/13/2021 09:50 AM
Collected: 12/2/2021

Project: **APURE21001**

Analytical Results

Client Sample Description LL-TIO6-1 Tutor Room ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0006*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
METALS								
NIOSH 7303	Titanium	<6.9	6.9	µg/m³	12/16/2021	WF	12/16/2021	WF

Client Sample Description LL-TIO7-01 East Halllway ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0007*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
METALS								
NIOSH 7303	Titanium	<9.5	9.5	µg/m³	12/16/2021	WF	12/16/2021	WF

Client Sample Description LL-TIO1-02 Blank ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0008*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
METALS								
NIOSH 7303	Titanium	<1.0	1.0	µg/filter	12/16/2021	WF	12/16/2021	WF

Client Sample Description LL-TIO2-02 Blank ***Collected:*** 12/2/2021 ***Lab ID:*** *162129088-0009*

Method	*Parameter*	*Result*	*RL*	*Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
METALS								
NIOSH 7303	Titanium	<1.0	1.0	µg/filter	12/16/2021	WF	12/16/2021	WF

Definitions:
MDL - method detection limit
J - Result was below the reporting limit, but at or above the MDL
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution Sample required a dilution which was used to calculate final results

162129088

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Industrial Hygiene - Chain of Custody

EMSL Order Number / Lab Use Only: 282103464

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: c@emsl.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information

Customer ID:	PENA75
Company Name:	Pennoni Associates
Contact Name:	Joe Cocciardi
Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055
Country:	USA
Phone:	717-516-7437
Email(s) for Report:	jcocciardi@pennoni.com, mpotts@pennoni.com, nvasquez@pennnoni.com

Billing Information

Billing ID:	PENA75
Company Name:	Pennoni Associates
Billing Contact:	Pennoni Associates
Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055
Country:	USA
Phone:	717-516-7437
Email(s) for Invoice:	jcocciardi@pennoni.com

Project Name/No: APURE21001
Purchase Order:

EMSL LIMS Project ID: (If applicable, EMSL will provide)
US State where samples collected: TX
State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)

Media Type: Cassette
Media Manufacturer/ Part Number:
Media Lot Number:

Sampled By Name: Michael Potts
Sampled By Signature:
No. Samples in Shipment: 18

Turnaround Time (TAT) Options - Please check: (If no selection made, Standard 2 Week (EOD) TAT will apply)
☐ 2 Week ☐ 1 Week ☐ 4 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day ☒ Other (Call Lab)

	Client Sample ID	Location/Description	Analyte/ Method	Media	Flow (lpm)	Sample Time On	Sample Time Off	Volume/Area	Sample Type	Sample Date	Comments
1	LL-TIO1-01	Early Childhood Workroom		PVC Cassette	2.57	0837	0925	123.36 L	☒ Area ☐ Personal	12/2/21	Hold at lab
2	LL-TIO2-01	Room 20		PVC Cassette	2.57	1110	1151	105.37 L	☒ Area ☐ Personal	12/2/21	
3	LL-TIO3-01	Room 12		PVC Cassette	2.507	1202	1255	132.87 L	☒ Area ☐ Personal	12/2/21	
4	LL-TIO4-01	Clinic		PVC Cassette	2.5	1334	1423	122.5 L	☒ Area ☐ Personal	12/2/21	
5	LL-TIO5-01	Cook Gym		PVC Cassette	2.485	1448	1529	101.89 L	☒ Area ☐ Personal	12/2/21	
6	LL-TIO6-01	Tutor Room		PVC Cassette	2.485	1519	1617	144.13 L	☒ Area ☐ Personal	12/2/21	
7	LL-TIO7-01	East Hallway		PVC Cassette	2.519	1730	1812	105.798 L	☒ Area ☐ Personal	12/2/21	
8	LL-TIO1-02	Early Childhood Workroom		MCE Cassette	2.505	0837	0925	120.24 L	☒ Area ☐ Personal	12/2/21	

21 DEC -7 AM 11:14

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)
Please hold at lab pending further instructions.

Method of Shipment: Fedex
Sample Condition Upon Receipt:

Relinquished by: Michael Potts — Date/Time: 12/6/21 1700
Received by: — Date/Time: 12/7/2021 0800

Relinquished by: — Date/Time:
Received by: (UPS) SS 12/13/21 9:50am Fx — Date/Time

Controlled Document - COC-21 Industrial Hygiene R4 05/12/2021

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(18)

KS 12/09/2021

Page 1 Of 2

OrderID: 162129088

162129088

EMSL ANALYTICAL, INC.
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Industrial Hygiene - Chain of Custody

EMSL Order Number / Lab Use Only
282103464

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: c@emsl.com

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

	Client Sample ID	Location/Description	Analyte/ Method	Media	Flow (lpm)	Sample Time On	Sample Time Off	Volume/Area	Sample Type	Sample Date	Comments
9	LL-TIO2-02	Room 20		MCE Cassette	2.509	1110	1151	102.869 L	☒ Area ☐ Personal	12/2/21	Hold at lab
10	LL-TIO3-02	Room 12		MCE Cassette	2.528	1202	1255	133.984 L	☒ Area ☐ Personal	12/2/21	
11	LL-TIO4-02	Clinic		MCE Cassette	2.52	1334	1423	123.48 L	☒ Area ☐ Personal	12/2/21	
12	LL-TIO5-02	Cook Gym		MCE Cassette	2.506	1448	1529	102.746 L	☒ Area ☐ Personal	12/2/21	
13	LL-TIO6-02	Tutor Room		MCE Cassette	2.48	1519	1617	143.84 L	☒ Area ☐ Personal	12/2/21	
14	LL-TIO7-02	East Hallway		MCE Cassette	2.489	1730	1812	104.538 L	☒ Area ☐ Personal	12/2/21	
15	LL-Blank-01-01	Blank		PVC Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
16	LL-Blank-01-02	Blank		PVC Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
17	LL-Blank-02-01	Blank		MCE Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
18	LL-Blank-02-02	Blank		MCE Cassette	N/A	N/A	N/A	N/A	☐ Area ☐ Personal	N/A	
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		
									☐ Area ☐ Personal		

RECEIVED
21 DEC -7 AM 11:14
EMSL CINNAMINSON, NJ

Method of Shipment: FedEx		Sample Condition Upon Receipt:	
Relinquished by: Michael Bates	Date/Time: 12/6/21 1700	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-21 Industrial Hygiene R4 05/12/2021

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EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077
800-220-3675
www.emsl.com

EMSL Order: 372121068
Customer ID: PENA75
Customer PO:
Project ID:

Attention: Joe Cocciardi
Pennoni Associates
4 Kacey Court
Mechanicsburg, PA 17055

Project: APURE21001

Phone: 717-516-7437
Fax:
Collected: 12/2/21 8:29am
Received: 12/7/21 9:50am
Processed: 12/8/21 3:15pm
Analyzed: 12/10/2021
Reported: 12/10/2021

Revision: 0.0

Bacterial Plate Count (EMSL Test Method MICRO-SOP-132)

Lab Sample Number	Customer Sample ID / Sample Location	Media	Incubation Temp °C	Sample Measure	Analytical Sensitivity (CFU /)	Dilution	Colony Count	CFUs (CFU /)
372121068-0001	LL-MB-1202-1 / Early Childhood Workroom	TSA	35.0	4 in2	2.5 / in2	10	0	None Detected
372121068-0002	LL-MB-1202-2 / Room 20	TSA	35.0	4 in2	2.5 / in2	10	27	68 / in2
372121068-0003	LL-MB-1202-3 / Room 12	TSA	35.0	4 in2	2.5 / in2	10	0	None Detected
372121068-0004	LL-MB-1202-4 / Clinic	TSA	35.0	4 in2	2.5 / in2	10	10	25 / in2
372121068-0005	LL-MB-1202-5 / Cook Gym	TSA	35.0	4 in2	2.5 / in2	10	3	7.5 / in2
372121068-0006	LL-MB-1202-6 / Innovation Lab 41	TSA	35.0	4 in2	2.5 / in2	10	0	None Detected
372121068-0007	LL-MB-1203-1 / Early Childhood Workroom	TSA	35.0	4 in2	2.5 / in2	10	0	None Detected
372121068-0008	LL-MB-1203-2 / Room 20	TSA	35.0	4 in2	2.5 / in2	10	0	None Detected
372121068-0009	LL-MB-1203-3 / Room 12	TSA	35.0	4 in2	2.5 / in2	10	54	140 / in2
372121068-0010	LL-MB-1203-4 / Clinic	TSA	35.0	4 in2	2.5 / in2	10	0	None Detected
372121068-0011	LL-MB-1203-5 / Cook Gym	TSA	35.0	4 in2	25 / in2	100	> 500	> 13000 / in2
372121068-0012	LL-MB-1203-6 / Innovation Lab 41	TSA	35.0	4 in2	25 / in2	100	> 500	> 13000 / in2

N/A=Not applicable

Vincent Iuzzolino
Microbiology Laboratory Manager
or Other Approved Signatory

OrderID: 372121068

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Microbiology Chain of Custody Form

EMSL Order Number / Lab Use Only

372121068

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson NJ 08077
PHONE: (800) 220-3675
EMAIL: CinnMicroLab@emsl.com

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EMSL
CINNAMINSON, NJ
21 DEC -7 AM 10: 37

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information		Billing Information	
Customer ID:	PENA75	Billing ID:	PENA75
Company Name:	Pennoni Associates	Company Name:	Pennoni Associates
Contact Name:	Joe Cocciardi	Billing Contact:	Joe Cocciardi
Street Address:	4 Kacey Court	Street Address:	4 Kacey Court
City, State, Zip:	Mechanicsburg, PA 17055	Country: USA	Mechanicsburg, PA 17055 Country: USA
Phone:	717-516-7437	Phone:	4 Kacey Court
Email(s) for Report:	jcocciardi@pennoni.com, mpotts@pennoni.com, nvasquez@pennoni com	Email(s) for Invoice:	jcocciardi.com

Project Information

Project Name/No: APURE21001

Purchase Order:

EMSL LIMS Project ID: (If applicable, EMSL will provide)

State Samples Collected: TX

Zip Code Samples Collected:: 75229

State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-taxable)

Sampled By Name: Michael Potts

Sampled By Signature:

No. of Samples in Shipment: 12

Sterile, Sodium Thiosulfate Preserved Bottle Used: ☐ Biocide Used in Source (specify)

Public Water Supply Samples: ☐ Note: All results may automatically be reported to DOH if required by State.

Turn-Around-Time (TAT) Please call ahead for large projects and/or turnaround times 6 Hours or Less. *32 Hour TAT available for select tests only; samples must be submitted by 11:30am.

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 32* Hour ☑ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week

MICROBIOLOGY TEST CODES

M001 Air-O-Cell	M174 MoldSnap	M012 *Pseudomonas aeruginosa* (P/A***)	M115 Sewage Screen - Water (P/A***)
M030 Micro 5	M032 Allergenco-D	M024 *Pseudomonas aeruginosa* (MFT*)	M116 Sewage Screen - Water (MPN**)
M041 Fungal Direct Examination		M015 Heterotrophic Plate Count	M117 Sewage Screen - Swab (P/A***)
M169 Pollen ID & Enumeration		M017 Total Coliform & *E. Coli* (Colilert P/A***)	M013 Sewage Screen - Swab (MFT*)
M280 Dust Characterization Level-1		M018 Total Coliform & *E. Coli* (MFT*)	M730 *Methicillin-resistant Staph, aureus* (MRSA)
M281 Dust Characterization Level-2		M114 Total Coliform & *E. Coli Enumeration (Colilert MPN***)*	M031 Rapid-growing non-TB *Mycobacteria* Detection & Enumeration
M005 Viable Fungi-Air Samples (Genus ID & Count)		M019 Fecal Coliform (MFT*)	
M006 Viable Fungi-Air Samples (Includes *Penicillium, Aspergillus, Cladosporium, Stachybotrys* Species ID & Count)		M020 Fecal *Streptococcus* (MFT*)	M014 Endotoxin Analysis
		M029 *Enterococci* (MFT*)	M044 Group Allergen (Cat, Dog, Cockroach, Dust Mite)
M007 Culturable Fungi-Surface Samples (Genus ID & Count)		M129 *Enterococci* (Enterolert P/A***)	M095 Bacteroides
M008 Culturable Fungi-Surface Samples (Includes *Penicillium, Aspergillus, Cladosporium, Stachybotrys* Species ID & Count)		M180 Real Time qPCR-ERMI 36 Panel	Other - See Analytical Price Guide for Test Code
		M025 Sewage Screen - Water (MFT*)	*Legionella Analysis* Please use EMSL *Legionella* COC
M009 Bacteria Culture Gram Stain & Count		*MFT= Membrane Filtration Technique	
M010 Bacteria Count & ID - 3 Most Prominent		**MPN = Most Probable Number	
M011 Bacteria Count & ID - 5 Most Prominent		***P/A = Presence/Absence	

Sample #	Sample Location/Description	Sample Type (Matrix)	Potable / Non-Potable (Only for Water)	Test Code	Volume/Area	Date / Time Collected	Temperature (Lab Use Only)
Example: Sample 1	Kitchen	Water	Potable	M017	1,000 ml	1/1/2021 3:30pm	
LL-MB-1202-1	Early Childhood Workroom	Swab		M114	4 in^2	12/2/21 08:29	
LL-MB-1202-2	Room 20	Swab		M114	4 in^2	12/2/21 10:03	
LL-MB-1202-3	Room 12	Swab		M114	4 in^2	12/2/21 10:41	
LL-MB-1202-4	Clinic	Swab		M114	4 in^2	12/2/21 12:03	
LL-MB-1202-5	Cook Gym	Swab		M114	4 in^2	12/2/21 13:39	
LL-MB-1202-6	Innovation Lab 41	Swab		M114	4 in^2	12/2/21 15:41	

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Method of Shipment: FedEx		Sample Condition Upon Receipt:	
Relinquished by: Michael Potts	Date/Time: 12/6/21 1700	Received by: FX	Date/Time 12.7.21 9:5
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-34 Micro R13 03/02/2021

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OrderID: 372121068

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Microbiology Chain of Custody Form

EMSL Order Number / Lab Use Only

372121068

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: CinnMicroLab@emsl.com

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample #	Sample Location/Description	Sample Type (Matrix)	Potable / Non-Potable (Only for Water)	Test Code	Volume/Area	Date / Time Collected	Temperature (Lab Use Only)
LL-MB-1203-1	Early Childhood Workroom	Swab		M114	4 in^2	12/3/21 08:55	
LL-MB-1203-2	Room 20	Swab		M114	4 in^2	12/3/21 09:30	
LL-MB-1203-3	Room 12	Swab		M114	4 in^2	12/3/21 09:59	
LL-MB-1203-4	Clinic	Swab		M114	4 in^2	12/3/21 12:22	
LL-MB-1203-5	Cook Gym	Swab		M114	4 in^2	12/3/21 13:50	
LL-MB-1203-6	Innovation Lab 41	Swab		M114	4 in^2	12/3/21 15:51	

Method of Shipment: Fedex		Sample Condition Upon Receipt:	
Relinquished by:	Date/Time: 12/6/21 1700	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-34 Micro R13 3/02/2021

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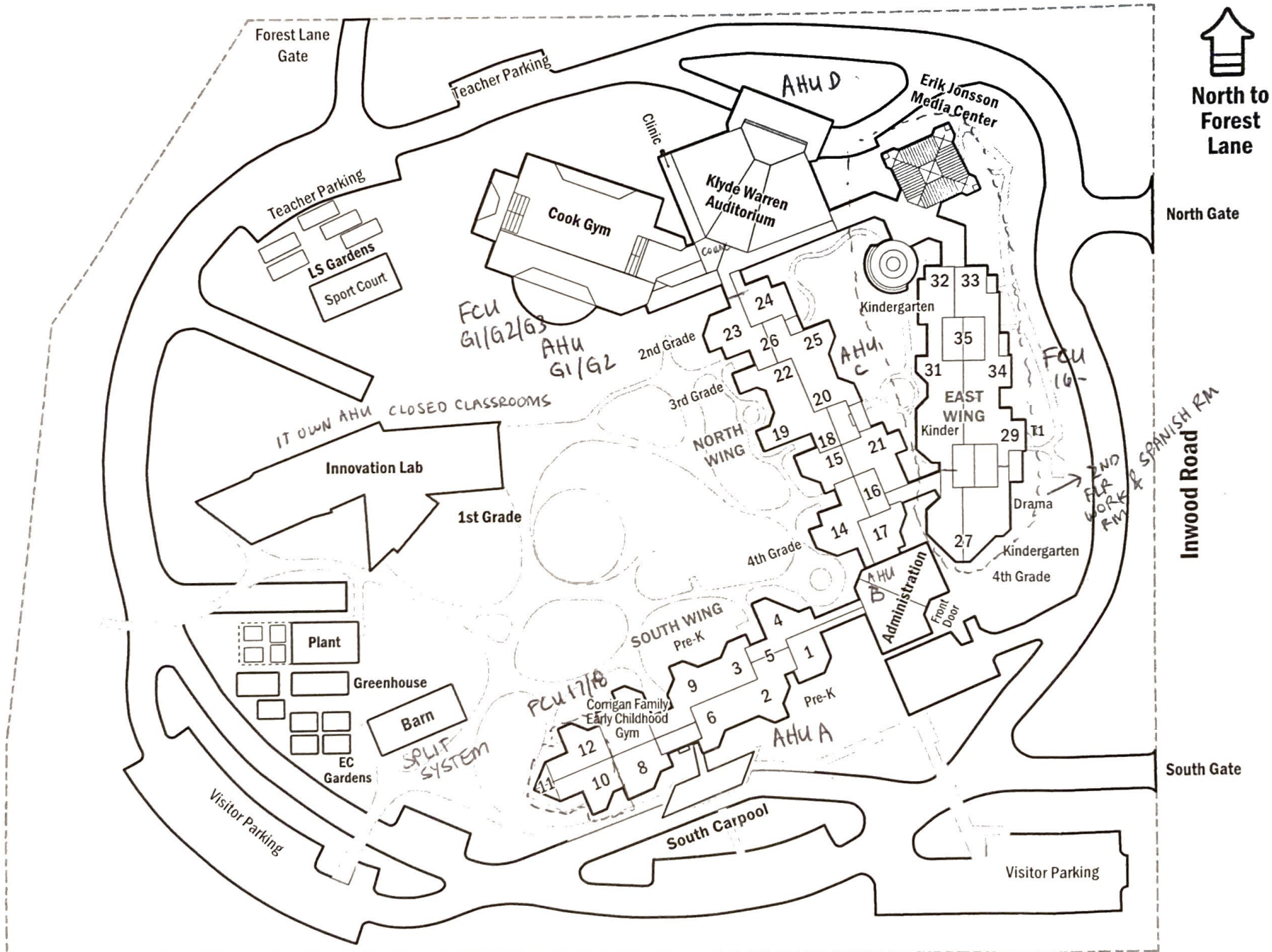
APPENDIX C

HVAC Information

		4-L Engineering	Delta		
Equipment Name	*Area Served*	*Equipment I.D*	*Address*	*Room*	*Controller Type*
AHU A	Early Childhood Wing	22	10003	BLDG A	DAC-633
AHU B	Administration	21	10004	Admin Office	DAC-633
AHU C	Lower School Wing	20	10005	BLDG C	DAC-633
AHU D	Auditorium	23	10011	Auditorium	DAC-633
AHU G1	Gym East	46	10007	Cook Gym	DNT-T221
AHU G2	Gym West	47	10008	Cook Gym	DNT-T221
FCU G1	Gym Lobby	45	10010	Cook Gym	DNT-T221
FCU G2	Gym Hallway	44	10006	Cook Gym	DNT-T221
FCU G3	Gym Office / Restrooms	48	10009	Cook Gym	DNT-T221
FCU 01	Art Room	33	10027	Art Rm	DNT-T221
FCU 02	Primary-Fine Arts Wing	34	10026	30	DNT-T221
FCU 03	4th Grade Upstairs	32	10025	Upstairs	DNT-T221
FCU 04	Development	59	10020	Upstairs	DNT-T221
FCU 05	T1	28	10021	29	DNT-T221
FCU 06	Second Grade Rm 34	29	10022	34	DNT-T221
FCU 07	Music	31	10024	28	DNT-T221
FCU 08	Second Grade Rm 31	30	10023	31	DNT-T221
FCU 09	Media Center Hallway	26	10017	Hall	DNT-T221
FCU 10	Second Grade Rm 32	27	10018	33	DNT-T221
FCU 11	Second Grade Rm 33	25	10019	32	DNT-T221
FCU 12	Media Center Office	35	10013	Library	DNT-T221
FCU 13	Media Center West	37	10016	Library	DNT-T221
FCU 14	Media Center East	38	10015	Library	DNT-T221
FCU 15	Media Center North	36	10014	Library	DNT-T221
FCU 16	Auditorium Hallway	65	10012	Hall	DNT-T221
FCU 17	Early Childhood Rm 10	40	10001	10	DNT-T221
FCU 18	Early Childhood Rm 12	39	10002	12	DNT-T221
Clinic	Clinic			Clinic	DNT-T221
Plant Chillers	Chill Water/Ice System		10100	Barn	DSC-1616E
Plant Boilers	Hot Water System		10200	Barn	DSC-1616E
Plant KW Monitor	KW Usage		10101	Barn	DFM-400P



THE Lamplighter

11611 Inwood Road
Dallas, Texas 75229
214-369-9201 Fax 214-369-5540

APPENDIX D

Campus Map

THE Lamplighter SCHOOL

11611 Inwood Road
Dallas, Texas 75229
214-369-9201 Fax 214-369-5540

APPENDIX E

Hydroxyl Radical Testing Protocol

Info & Instructions on Shipped Methylene Blue Test Strips

Tracking #: USPS EJ960896519US

Wet Test Strips:

Batch #1 – "Original" Wet Strips (~40 short strip & 30 long strips)

- ~0.05 M NaOH with 1.5 M glucose (reducing agent)
- ~0.5 mg/mL Methylene Blue dye
- 2 Vials (short & longer strips); solutions should be gray to yellow in color; if blue, top vial with water, seal, gently sake and let stand until blue color diminishes

Batch #2 – "Saturated" Wet Strips (~40 short strip & 40 long strips)

- ~0.1 M NaOH with 1.5 M glucose (reducing agent)
- > 1 mg/mL Methylene Blue dye
- 2 Vials (short & longer strips); gray precipitate should be present in vial; this should be excess reduced methylene blue. The solution may have a faint gray-blue color to it

For Use: Extract a wet test strip with tweezers and place on a white surface (or even a piece of the large filter paper provided); start timer and monitor how long it takes until the strip turns its **maximum blue color (a bold light blue for the original strips & a darker strong blue for the saturated strips)**; a control test (actually 2-3) should be run in a normal room to establish the baseline time for color change due to oxygen in the air **(~5 minutes for full color change)**. New test strips can then be placed near the "purifying" devices in areas to see if the level of oxidizers in the air are higher or the same. Higher presence of oxidizers (such as the **OH·** radical) in the air should shorten the time the strips take to fully turn blue. If negligible levels of **OH·** are being added to the air then color change times should be similar to the controls.

NOTE: When opening the test strip vials try not to disturb the solution too much as this will inject oxygen and turn the solution blue; if this occurs, simply reseal the tube, gently shake and then let stand until all of the blue color disappears (this occurs as the glucose reduces the dye).

Extra Dropper Test Method:

- **1 vial** of saturated methylene blue/glucose solution
- **1 box of small filter paper**
- **1 box of larger filter paper**
- **1 mL pipettes**

For Use: This is just an extra simple method if the strips are giving you trouble. To test control environments or the oxidizing environments place 2-3 small filter paper discs on top of a larger filter paper disc on the aluminum foil provided (or another surface that can be cleaned). Then drop 0.5 mL (2nd line on pipette) of the saturated MB solution onto the center of each disc so that the solution fully saturates the small disc. Then time the progression of the color change. **NOTE:** When pipetting the saturated MB solution make sure to pipette from the middle of the vial and not the very top (the top region may start turning blue when the vial is open as it is exposed to the air). Again, if the solution turns blue in the vial then just close the vial, shake a bit (will turn more blue), and then let stand until the dye fully reduced by the glucose again.