INDOOR AIR QUALITY ASSESSMENT
PALOMAR COMMUNITY COLLEGE
HEALTH CENTER – BUILDING HC-100
1140 WEST MISSION ROAD
SAN MARCOS, CALIFORNIA

PREPARED FOR:
Palomar Community College
1140 West Mission Road
San Marcos, California

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
5710 Ruffin Road
San Diego, California 92123

April 21, 2017
Project No. 108182005

April 21, 2017
Project No. 108182005

Mr. Derrick Johnson
Supervisor, Environmental Health and Safety
Palomar Community College
1140 West Mission Road
San Marcos, California

Subject: Indoor Air Quality Assessment
Palomar Community College
Health Center – Building HC-100
1140 West Mission Road
San Marcos, California

Dear Mr. Johnson:

In accordance with your request and authorization to proceed, Ninyo & Moore has performed a visual inspection and limited indoor air quality assessment of the interior of Building HC-100 (Health Center) at the Palomar Community College (PCC) campus located at 1140 West Mission Road in San Marcos, California. The assessment was conducted in response to indoor air quality complaints from several individuals working within the building, and general concern over indoor air quality within the interior spaces.

Ninyo & Moore's scope of services included visual inspection of the air handling system and affected areas, and air sampling of the interior spaces including total airborne particulate via spore-trap, ultrafine particulate via condensation particle counter, total volatile organic gases and vapors via real-time instrumentation and evacuated canister, and the general indoor air quality parameters of carbon monoxide, carbon dioxide, temperature and relative humidity in selected indoor and outdoor areas. The attached report presents our methodology, observations, results, conclusions and recommendations. We appreciate the opportunity to be of service to you on this project.

Sincerely,
NINYO & MOORE

Nicolas Carpenter, CAC
Project Environmental Scientist

Stephen J. Waide, CIH, CSP, CIEC, CMC
Principal Environmental Scientist

NJC/SJW/gg

Distribution: (1) Addressee

TABLE OF CONTENTS

Page

1. VISUAL INSPECTION 1
2. GENERAL MEASUREMENT OF INDOOR AIR QUALITY 1
3. AIR SAMPLING FOR VOLATILE ORGANIC COMPOUNDS 2
4. PARTICULATE AIR SAMPLING METHODOLOGY 3
5. EXPOSURE GUIDELINES AND INTERPRETATION OF RESULTS 4
   - 5.1. Temperature and Relative Humidity 4
   - 5.2. Carbon Monoxide 4
   - 5.3. Carbon Dioxide 5
   - 5.4. Mold Spore and Total Particulate Air Sampling Results 5
   - 5.5. TO-15 Sampling Results 6
6. CONCLUSIONS AND RECOMMENDATIONS 7
7. LIMITATIONS 8

Table

Table 1 – Ranges of Typical Outdoor and Indoor Particle Concentrations

Appendices

Appendix A – Instrument Calibration Record
Appendix B – Laboratory Reports and Chain-of-Custody Record
Appendix C – Photographic Documentation

1. VISUAL INSPECTION

A Ninyo & Moore Certified Industrial Hygienist (CIH) and the Palomar Community College Environmental Health and Safety Supervisor performed an initial visual inspection within the affected spaces on April 7, 2017 in order to discuss the complaint areas and develop a sampling strategy. Further inspection and field sampling was performed by the CIH on April 14, 2017, which included visual inspection of the heating, ventilation and air conditioning system and comprehensive sampling within the building's interior spaces.

Building HC-100's interior spaces are supplied conditioned air from a pad-mounted Carrier® air handling unit (AHU) on the building's east side and all interior spaces appeared to be well ventilated and maintained. The brand new AHU including filters appeared clean although information on the efficiency of the filters themselves was unavailable. The AHU was operating throughout the day during our assessment and appeared dry and visibly clean of debris and biological growth.

Interior surfaces of the building appeared to be clean, well maintained and with no noticeable odor or visible dust on room surfaces. Ninyo & Moore personnel began the initial assessment at approximately 0800 and performed air sampling activities throughout the day. A gas and vapor sampler was functioning all day to capture a representative time-weighted exposure while particulate sampling was performed for short durations in several areas.

2. GENERAL MEASUREMENT OF INDOOR AIR QUALITY

Air monitoring for general indoor air quality parameters is typically performed by indoor air quality professionals as a general indicator of whether air handling systems are properly balanced and appropriate indoor and fresh outdoor air mixing is occurring. Ninyo & Moore performed this monitoring using a calibrated Q-TRAK® Indoor Air Quality Meter (TSI Instruments, Model No. 7575) during air sampling activities on April 14, 2017. The parameters measured included temperature (Temp), relative humidity (rH), carbon monoxide (CO), and carbon dioxide (CO_2). The following is a summary of the measurements obtained:

- **Temp –** The temperature within Building HC-100 ranged from approximately 66.1 to 71.8 degrees Fahrenheit (º F). The outside temperature was approximately 59 to 69º F throughout the day.

- **rH –** The relative humidity within Building HC-100 ranged from approximately 34 to 58 percent. The outside relative humidity ranged from approximately 30 to 59 percent.

- **CO –** The CO readings within Building HC-100 and immediately outdoors were consistently less than 0.3 part per million (ppm).

- **CO_2 –** CO_2 readings within Building HC-100 ranged between 520 and 800 ppm during sampling activities throughout the day. The outside CO_2 readings maintained approximately 420 ppm.

A copy of the calibration certificates for the instruments used is provided in Appendix A.

3. AIR SAMPLING FOR VOLATILE ORGANIC COMPOUNDS

A photoionization detector (PID), with a detection limit in the parts per billion (ppb) range was used on-site to detect any ambient volatile organic compounds within Building HC-100 in real time. The intent was to use this qualitative instrument to locate areas of high organic vapor (or "hot-spots") for further sampling. Indications of organic vapor ranged from approximately 100 to 500 ppb with no reproducible "hot-spots" identified.

A certified clean stainless steel evacuated canister was also used just outside of Room HC-102 to capture a representative sample of the indoor air for subsequent analysis via Mass Spectroscopy using Environmental Protection Agency (EPA) Method TO-15. The canister was placed at approximate breathing zone height for a seated individual in the main complaint area. The canister remained in the area for the entire day. The sampling location was selected to best represent complaint areas and to attempt to capture contaminants that may be facilitating discomfort of the employees. Since there was no identified vapor hot spot indicated during our walkthrough prior to sampling, locations were chosen based solely on complaint areas identified by PCC. TO-15 analysis is used to identify a wide variety of organic compounds through gas chromatography and mass spectroscopy and is commonly used to identify indoor air quality contaminants.

The 6-liter evacuated canister was supplied and pre-cleaned by EMSL Analytical Incorporated. The approximate 8-hour sample was collected by opening the valve on the canister to collect a sample of the air within the specified area until the canister obtained nearly equalized pressure with ambient surroundings. The evacuated canister was labeled with an identification number, documented on a chain-of-custody form, and submitted to the laboratory for analysis by US EPA Method TO-15. The sample was returned to EMSL, an American Industrial Hygiene Association (AIHA) accredited laboratory. Laboratory reports and chain-of-custody documentation are presented in Appendix B.

4. PARTICULATE AIR SAMPLING METHODOLOGY

A condensation particle counter was used to assess any unusual condition associated with the presence of ultra-fine particles (UFPs) that were present, resulting from sources of combustion, chemical reaction or malfunctioning office equipment. Respiration of UFPs can challenge the body's natural defense mechanisms and overexposure may strain these mechanisms, causing an adverse reaction. Measurements of UFPs within Building HC-100 during this assessment were consistently between approximately 500 to 4,000 particles per cubic centimeter of air (pcc) with outdoor readings measured between 3,500 and 10,800 pcc with no unusual conditions noted.

Air samples were also collected within Building HC-100 for the evaluation of total airborne spores and other particulates using Zefon™ Air-O-Cell sampling cassettes and a high-volume, rotating vane Gast™ sampling pump (calibrated to 15 liters of air per minute). The Air-O-Cell sampler is a particulate sampling cassette designed for the rapid collection and analysis of a wide range of airborne aerosols, including mold spores (to the genus level). This sampling device is useful in providing rapid analysis of airborne contaminants in indoor air quality testing. Samplers were calibrated on site immediately before use and samples drawn for a period of five minutes each, one just outside Room HC-106, one just outside of Room HC-113 and two just outside the building (in the outdoor environment). Each collected air sample was labeled with a unique identification number corresponding to the sample location.

Collected samples were documented on a chain-of-custody form and submitted to the laboratory for analysis. Samples were submitted to Environmental Microbiology Laboratory (EMLab) of Irvine, California. EMLab is an American Industrial Hygiene Association Environmental Microbiology Accredited Laboratory. The laboratory reports and Chain-of-Custody (COC) forms are included in Appendix B.

5. EXPOSURE GUIDELINES AND INTERPRETATION OF RESULTS

5.1. Temperature and Relative Humidity

Temperature and relative humidity were measured at various times and locations inside Building HC-100 and immediately outdoors to determine if these air quality parameters fall outside the ASHRAE recommended ranges. Measurements outside of the recommended ranges can be indicative of problems with building design or maintenance. On April 14, 2017 the temperature inside the building ranged from approximately 66 to 72 º F and the indoor relative humidity ranged from approximately 34 to 58 percent. These conditions were found to be similar to the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) comfort parameters of 68 to 74 degrees Fahrenheit (wintertime) and 30 to 65 percent relative humidity.

5.2. Carbon Monoxide

Direct instrument readings indicated that CO concentrations in the surveyed areas were consistently less than 0.3 ppm. Although there are no federal regulations governing CO exposure limits in non-industrial indoor environments, the USEPA has set National Primary Ambient Air Quality Standards for Outdoor Air to be used in locating ventilation sources for buildings. Exposure limits for CO have been established at a maximum of 35 ppm for one hour, not more than one time per year, or 9 ppm over any eight-hour period. The American Conference of Governmental Industrial Hygienists (ACGIH) and the Occupational Safety and Health Administration (OSHA) have established similar maximum exposure limits in the Industrial Workplace Standard. In view of these guidelines, the CO concentrations measured in the surveyed areas are not considered significant.

5.3. Carbon Dioxide

CO_2 is a good indicator of proper ventilation within a building environment and the ASHRAE's Standard 62 recommends an indoor level not to exceed 650 ppm above outdoor ambient air. Carbon dioxide concentrations above 1,000 ppm can cause occupants to feel sluggish and may be indicative of low ventilation rates. Direct-reading instruments employed during the study showed CO_2 levels inside Building HC-100 during sampling activity to be generally between 500 and 800 ppm, with measured outdoor levels at approximately 420 to 460 ppm. This is considered to be well within the recommended balance of outdoor to re-circulated indoor air and indicates a building that is efficiently removing indoor air and properly mixing fresh, outdoor air.

5.4. Mold Spore and Total Particulate Air Sampling Results

Since there are no regulated exposure threshold levels for molds, the American Conference of Governmental Industrial Hygienists and the United States Environmental Protection Agency guidelines suggest that interpretation of air sampling results should be generally based on comparison of indoor and outdoor spore contents. In addition, it is common industry practice to compare outside bioaerosol concentrations and genera to inside bioaerosol concentrations and genera. If the indoor concentration is significantly higher than the outdoor concentration, or if different spore types are present indoors and outdoors, then indoor fungus sources (amplifiers) are presumed to exist. These observations are guidelines only. Variation is an inherent part of airborne spore sampling and the presence of a few different genera in small numbers should not be considered abnormal.

Results of the spore trap samples collected from the interior of Building HC-100 were compared to the exterior (background) sample results. All spore types identified indoors were detected in the background samples collected on the same day within minutes of the interior samples. In addition, the total spore counts detected in the background samples showed similar spore types and higher average concentrations than those found in the interior samples. The results of sampling were considered to be representative of a "normal indoor fungal ecology" and the slight variation in spore types is considered consistent with variation seen in common practice. A copy of the laboratory results associated with spore trap air sampling at the site is provided in Appendix B.

Other biological and non-biological particles were also detected in indoor air during our assessment as indicated in the laboratory report in Appendix B. Pollens, epithelial (skin) cells, fungal hyphal fragments, starch particles and miscellaneous fibers was detected in indoor air. There are no exposure limits for these particulates commonly detected in indoor air but these concentrations are typically noted and compared to local laboratory databases to determine whether any contaminant is present in an abnormal or elevated concentration. For comparison, a table is provided below which summarizes typical indoor levels of some of these commonly detected contaminants. The table is provided by EMLab P&K, a TestAmerica Company, in the IAQ Pocket Reference Guide 7th Edition, copyrighted in 2012 and published in January 2013. A copy of the laboratory results associated with particulate air sampling in the HC-100 Building and outdoors is provided in Appendix B.

Table 1 – Ranges of Typical Outdoor and Indoor Particle Concentrations

Particle Type	Outdoor Environment (counts/m^3)	Indoor Environment (counts/m^3)			HC-100 Results
		Low	***Moderate***	***High***	
Pollen	ND-5000	ND-50	50-100	>100	13-40
Glass fibers	ND-80	ND-80	80-200	>200	0-27
Epithelial cells	ND-1500	ND-10,000	10,000-15,000	>15,000	150-4,900

Note:
ND = None detected

5.5. TO-15 Sampling Results

An evacuated canister was staged in the main complaint area of HC-100 to capture a representative sample of the indoor air in the area for subsequent analysis via Mass Spectroscopy. The canister was placed just outside of Room HC-102. The analytical method (USEPA Method TO-15) includes analysis of a broad spectrum of volatile organic vapor analytes. Results of the laboratory analysis of the indoor air indicated the usual levels of indoor air contaminants with the highest concentrations being ethanol, acetone and isopropyl alcohol, which are almost always found in indoor environments in low concentrations due to the use of cleaning products.

The only other indoor air quality contaminants positively detected were chloromethane, dichlorodifluoromethane, trichlorofluoromethane, acetonitrile and ethyl acetate in trace quantities. Chloromethane was once widely used as a refrigerant as is dichlorodifluoromethane and trichlorofluoromethane. Acetonitrile is a common solvent and ethyl acetate is used in glues, nail polish remover and decaffeinated drinks. All of these are relatively common indoor air contaminants in the trace concentrations detected. All detected contaminants exhibit very low toxicity and those with exposure limits were found in concentrations that are orders of magnitude below levels that should cause discomfort in an indoor environment. The laboratory report compares the detected chemicals to the exposure limits in the table Entitled "NIOSH and OSHA Exposure Limit Comparisons." Laboratory reports and chain-of-custody documentation are presented in Appendix B.

6. CONCLUSIONS AND RECOMMENDATIONS

Indoor air quality parameters investigated during this assessment included temperature, humidity, CO levels, CO_2 levels, airborne gases and vapors, ultrafine particles and total spore and particulate concentrations. Air quality measurements were performed throughout the day within HC-100, and air samples were collected from within several areas for nearly a full day during the work week. Real-time readings throughout the day indicated that the building is efficiently removing indoor air and properly mixing fresh, outdoor air.

Spore and particulate concentrations were measured in two areas within Building HC-100 and indicated what should be considered a "normal indoor fungal ecology" with low levels of particulate contaminants such as epithelial (skin) cells. Cellulose fibers while possibly slightly elevated for a service environment, were in the normal range for an office environment. An evacuated canister was utilized in a complaint area and submitted to a laboratory for subsequent analysis via Mass Spectroscopy. The analytical method (USEPA Method TO-15) included analysis of a broad spectrum of volatile organic vapor analytes. Some chemicals, most commonly associated with household and commercial cleaning products, were detected in the part per billion range, including ethanol, acetone, and isopropyl alcohol. The levels of

the detected compounds were present in concentrations that should not cause concern. Particularly toxic compounds or compounds widely recognized as being carcinogenic were not identified in the laboratory analysis.

In summary, during on-site investigation, Ninyo & Moore could not find sufficient evidence to corroborate any untoward condition in the indoor air within Building HC-100. This is not to say that an untoward condition was never present. The reported chemical exposure that sickened one or more individuals within the building may have come from an external source which infiltrated the air handling system from outside. Unspecified construction activities were reported in the immediate area during the week of the initial incident and the application of paints and coatings often involves vapors that cause problems of this type for some individuals.

Based on all of the findings mentioned above, no further action is recommended concerning further specialized investigation of indoor air quality in Building HC-100 at this time. The individual who became sick however may have a chemical sensitivity that may need to be addressed in the workplace. Portable air purifiers often provide some relief in cases where individuals are especially sensitive to trace chemicals however these cleaners typically are effective only in small, isolated spaces such as enclosed offices where the air can be more effectively contained. The air purifier would need to be particularly effective for gases and vapors, which usually involves activated carbon as part of the filtration media.

7. LIMITATIONS

Air sampling results are limited in that they represent airborne concentrations at the time of sample collection only. Changes in weather, operating procedures, ventilation, temperature, humidity, occupant practices and other conditions including construction activities in the immediate area, may cause variations in anticipated indoor airborne concentrations.

Ninyo & Moore has performed the tasks set forth above in a thorough and professional manner consistent with industry guidelines and under supervision of a certified professional. Ninyo & Moore cannot guarantee and does not warrant that this limited assessment has revealed all adverse environmental conditions affecting the site. Nor can Ninyo & Moore warrant that the assessment requested would satisfy the dictates of, or provide a legal defense in connection with, environmental laws or regulations.

The results reported and any opinions reached by Ninyo & Moore are for the benefit of the client. Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. It should be understood that changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge.