



Geomatrix

Technical Memorandum

TO: Ms. Debbie Lane
County of El Dorado
Property and Lease Manager

DATE: May 2, 2008

FROM: Mr. Kim M. Worl, CIH
Geomatrix Consultants

PROJ. NO.: 12664.001

CC: Mr. Larry Costello
County of El Dorado
Risk Management Analyst

SUBJECT: **Results of the Indoor Air Quality Assessment
Placerville Masonic Center, 471 Pierroz Road, Placerville, California**

INTRODUCTION

This technical memorandum presents the results of the indoor air quality assessment that was conducted in the first floor office spaces at the Placerville Masonic Center located at 471 Pierroz Road in Placerville, California. These offices, which are currently vacant, are being considered for occupancy by an El Dorado County agency. Based upon historical concerns regarding indoor air quality in the offices, you requested that a general evaluation of air quality be performed in the offices, prior to re-occupancy.

The indoor air quality assessment, which I performed on April 1, 2008, consisted of the following three tasks.

1. A walk-through inspection of the office spaces.
2. An inspection of the heating, ventilation, and air conditioning (HVAC) system that service the offices.
3. Air sampling for airborne particulates (e.g., mold spores, pollens, and miscellaneous aerosols).

The remainder of this technical memorandum describes the study methods, presents the results of the assessment, summarizes the conclusions drawn from the assessment and, as appropriate, offers recommendations for improving air quality in the office areas.

STUDY METHODS

Work Area Inspection

An initial walk-through visual inspection was performed throughout the vacant first floor office spaces. The inspection focused on identifying conditions and/or circumstances that could influence the quality of indoor air in the offices, including evidence of water intrusion, excessive surface dirt and debris, chemical storage, etc.



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Ventilation Evaluation

Because of the strong influence of ventilation on indoor air quality, the ventilation system servicing the office areas was evaluated for cleanliness and general operational condition. Measurements of standard indoor air quality parameters were also made throughout the office areas.

Ventilation Inspection

The office spaces are serviced by seven packaged HVAC units located in mechanical closets distributed along the northern portions of the office spaces. Each of the HVAC units was visually inspected for cleanliness, operational status, and the presence of potential contaminants that could affect indoor air quality. The outside air intakes, system filters, and mixing-chamber surfaces were visually inspected for cleanliness and maintenance upkeep.

General Indoor Air Quality Parameter Measurements

Measurements of general indoor air quality parameters, including carbon dioxide (CO₂), temperature, relative humidity, and carbon monoxide (CO), were collected from five locations throughout the office spaces during the assessment. The measurements were collected using a Q-Trak Model 8550 IAQ Monitor. This instrument provides a continuous, direct readout of each of the parameters.

Air Sampling

Samples for airborne particulates were collected from three indoor locations to assess the relative types and concentrations of particulate in the indoor air. A background sample was also collected outside the building. The background air sample provides useful comparison data from which to evaluate the significance of the measurements collected inside the building.

Airborne Particle Characterization Samples

A variety of types of airborne particulate may be present within buildings. The overall airborne particulate material may consist of organic materials (e.g., mold spores, pollens, natural fibers, skin cells, etc.) and inorganic materials (e.g., mineral fibers, soil particles, opaque materials, etc.). Evaluating the types of particulate and their relative concentrations and distribution within a structure is useful in identifying potential sources and causes for some indoor air concerns. Excessive concentrations of mold spores may reveal microbial proliferation occurring in the building. Elevated concentrations of mineral fibers or paint particles in a specific work area may indicate that the sound liner or insulation within the ventilation system is deteriorating.



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The samples were collected using a Dayton/BGI high-volume, air-sampling pump to draw air through a Zefon Analytical bioaerosol sampling cassette. This specially designed air sampling cassette uses the principle of impaction to capture airborne particulate on a thin layer of transparent oil that has been applied to a slide contained in the cassette. The samples were collected for 8 minutes at a sample flow rate of 15 liters of air per minute (l/min). The sample pump was calibrated prior to and at the completion of sampling using a precision high-flow rotometer.

The samples were submitted to Environmental Analysis Associates, Inc. (EAA) located in San Diego, California. EAA specializes in the evaluation and characterization of particulate contaminants associated with indoor air quality. The samples were analyzed by inspecting the captured material using polarized and phase-contrast microscopy.

STUDY RESULTS

This section presents the results of the indoor air quality assessment that was conducted in the first level office spaces of the Placerville Masonic Center located at 471 Pierroz Road in Placerville, California, on April 1, 2008.

Facility Description/Background

The Placerville Masonic Center is a two level commercial building that was constructed in approximately 1987. The building is located on a hillside, with parking areas and ground level entrances to the first level offices on the south side of the building and entrances to the Masonic Lodge on the second level along the northern side of the building. The first level office spaces had been occupied by the County of El Dorado Probation Department up until late March of 2008. The office spaces have remained vacant since the time the Probation Department moved out in late March. At this time, another County agency is considering occupying the offices. Based upon some historical concerns associated with air quality in the office spaces, the potential tenant requested that the current status of air quality in the offices be evaluated.

Office Inspection

A walk-through inspection was performed throughout the first level office areas to identify circumstances and/or conditions that could influence air quality in the building. No unusual circumstances or conditions were observed that would be expected to cause unusual influences to air quality in the offices. The results of the inspection are summarized below.



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- Water staining was noted on several suspended ceiling tiles throughout the office areas. The staining appeared to be historical, with no indication of ongoing water intrusion. The magnitude of the staining is considered minor and there was no indication of mold growth associated with the stained ceiling tiles.
- Moderate staining, soiling, and wear are apparent to portions of the installed carpeting in the eastern-central and main office areas.
- There was no evidence (water-damaged sheetrock, stained carpeting, etc.) of unusual water intrusion along the exterior perimeter walls.
- The ventilation supply diffusers were generally observed to be slightly soiled.

Results of Ventilation Evaluation

HVAC Unit Inspections

Ventilation to the office areas is provided by seven HVAC units located in five mechanical closets distributed along the northern portions of the office area. Each of the units was visually inspected for potential conditions or circumstances that could impact indoor air quality. Reportedly, the ventilation system had not been operational on a regular basis since the Probation Department vacated the building. On the day of this evaluation, the ventilation system was turned on approximately two hours prior to the indoor air quality assessment.

The results of the visual inspection are summarized below.

- Visual inspection of each of the HVAC units revealed them to be generally clean and only slightly soiled.
- Each of the units was equipped with 1-inch thick, extended surface, pleated filters which were observed to be clean/slightly soiled. The quality of these filters is considered appropriate for general usage office environments.
- The units appeared clean and well maintained, with no apparent conditions that would be expected to diminish the quality of indoor air in the offices.
- Minor wood debris and dust was observed in the return air plenum beneath Unit #6, which is located in mechanical closet #4. This debris could become entrained into



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the ventilation system and distributed into the offices. The plenum area should be cleaned.

- Outside air is provided to each of the units through ductwork that draws air from intakes installed in the soffit overhang along the exterior southern side of the building. Booster fans have been added to the outside air intakes to promote entrainment of outside air into each of the units. At the time of this evaluation, the booster fans for Units #5 and #6 were not operating.
- The interior portions of the HVAC units, including the coils and condensate drip pan and condensate drain line, could not be accessed at the time of this inspection.

Results of Carbon Dioxide, Temperature, Relative Humidity, and Carbon Monoxide Measurements

The results of the indoor air quality parameter measurements are presented in the following Table.

Location	Time	Carbon Dioxide Concentration (ppm)	Temperature (°F)	Relative Humidity (%)	Carbon Monoxide (ppm)
Outdoor, Front	1215	342	63	31	1.4
Eastern Workstation Area	1225	377	67	33	1.5
Reception Area	1237	373	67	33	1.5
Main Central Workstation Area	1243	383	66	34	1.5
Western Central Workstation Area	1252	377	64	36	1.5
Western Workstation Area	1258	386	70	34	1.5

CO₂ concentrations throughout the office spaces were low, very similar to background (outdoor) concentrations. This is consistent with the offices being unoccupied and vacant at the time of the assessment. Indoor temperatures were 1 to 7 degrees higher than outdoors, indicating that the HVAC units were operating and were gradually warming the interior spaces. Relative humidity was similar to background and generally consistent throughout the office areas, with no indication of unusual moisture levels. CO concentrations inside the building were also very similar to background concentrations.



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Results of Air Sampling

Samples for airborne particulates were collected from three indoor and one background location outside of the building.

Results of Airborne Particulate Sampling

The results of the particle characterization air samples are presented in Table 1 (attached). Three general types of airborne particulates are characterized using this sampling technique: mold spores, pollens, and miscellaneous aerosols.

Normally, indoor mold spores will be present at or below the outdoor types and concentrations, with the most abundant indoor types mimicking the most abundant outdoor types. The presence of low concentrations of a few spore types indoors at slightly higher concentrations than outdoors (or not detected outdoors) is also a common observation and is not considered indicative of significant mold proliferation indoors.

Total mold spore concentrations measured in the office areas ranged from 137 to 377 counts per cubic meter of air (c/M^3). The total mold spore concentration measured outdoors was $3,263 c/M^3$. The highest indoor total mold spore concentration was measured in the eastern main workstation area. The concentration measured in this area represents less than 12 percent of the total mold spore concentration measured outdoors. The general "rule of thumb" for evaluating total mold spore concentrations indoors is that typical indoor airborne spore concentrations should be less than $2,000 c/M^3$ and/or less than 2 times the outdoor concentration.

Other guidance presented in the literature for evaluating mold spore concentrations include:

- Less than $2,000 c/M^3$: "Clean building".
- $2,000$ to $5,000 c/M^3$: Potential indoor amplification of molds may be occurring. Medical symptoms possible in sensitive individuals.
- $10,000$ to $6,000,000 c/M^3$: Chronic indoor amplification of molds. Potential serious medical symptoms in sensitive and non-sensitive individuals.

Based upon the evaluation criteria, the measured total mold spore concentrations are considered low and show no indication of unusual water intrusion or mold growth occurring indoors.



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Three types of mold spores were detected in one or more of the indoor samples and four types were detected in the outdoor sample. One mold spore type, *Cladosporium*, was detected at low concentrations in two of the indoor samples and was not detected outdoors. The presence of this mold spore type indoors at the measured concentrations is not considered unusual or significant. Of the mold spore types that were common to both the indoor and outdoor environments, none of the indoor concentrations exceeded the concentrations measured outdoors.

Airborne pollens were detected at low concentrations (8 c/M^3) in two of the indoor locations. In typical air conditioned office buildings, airborne pollen concentrations are generally very low, less than 30 c/M^3 . Most individuals with pollen allergies will begin to exhibit symptoms when pollen counts exceed approximately 50 c/M^3 .

Miscellaneous aerosols are a group of airborne particles comprised primarily of skin-cell fragments, organic fibers, and ash/opaque particles. The measured concentrations of skin-cell fragments indoors ranged from 2,907 to $13,029 \text{ c/M}^3$. The general evaluation criteria for skin-cell fragment concentrations includes:

- 50 to 1000 c/M^3 : Outside Air;
- 500 to $10,000 \text{ c/M}^3$: Inside air "clean building";
- 5,000 to $20,000 \text{ c/M}^3$: Inside air "high human activity"; and
- Greater than $20,000 \text{ c/M}^3$: Inside air "high personnel density and/or poor housekeeping".

While no direct health effects have been attributed to skin-cell fragments, their presence and concentration are considered a good indicator of effective fresh-air and supply-air transfer, HVAC filtration, occupant density, and janitorial effectiveness. The concentrations of skin-cell fragments measured in the central main area and the western main area were within the range defined for "Clean Buildings". The concentration measured in the eastern main area was notably higher than the other areas, falling within the range as defined for "High Human Activity". The elevated concentration of skin cell fragments in the eastern main area suggests that this area is more heavily soiled than the remainder of the office spaces.

Fiberglass and mineral wool fibers were not detected in any of the air samples. Airborne cellulose fiber concentrations measured in the office areas were well below the concentrations defined for typical office environments (less than $10,000 \text{ c/M}^3$ for organic



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fibers). It is worth noting that consistent with the skin cell fragments, the highest concentration of organic fibers was measured in the eastern main area.

The concentrations of opaque particles measured in the office areas ranged from 1,920 to 9,771 c/M³, with the highest concentration being measured in the eastern main area. The outdoor concentration of opaque particles was 7,087 c/M³. Typically, this group of particles is primarily made up of combustion products from internal-combustion engines, dirt particles, and paint or paint-like binders. Because the particles are generally opaque, their make-up and source(s) are difficult to determine.

Consistent with the measured concentrations of skin-cell fragments and organic fibers, the eastern main area contained the highest concentration of opaque particles.

CONCLUSIONS

The following conclusions are drawn based on the observations and findings made during the indoor air quality assessment conducted on April 1, 2008, in the first level office areas of the Placerville Masonic Center located at 471 Pierroz Road, in Placerville, California.

- The indoor air quality assessment did not identify any current conditions, circumstances, or airborne contaminants that are significantly diminishing the quality of indoor air within the office spaces.
- Visual inspection of the office areas did not identify any unusual sources for indoor air contaminants. Although minor areas of water staining were affecting multiple suspended ceiling tiles throughout the office area, the staining appeared to be historical in nature and no areas of suspect mold growth were observed. The specific cause(s) of the water staining could not be determined at the time of this site visit.
- The inspection of the HVAC units that service the office area revealed the units to be generally clean and well maintained, with no apparent sources for indoor air contaminants.
- Sampling for airborne particles revealed low indoor concentrations of mold spores in the office areas. The measured concentrations of miscellaneous aerosols suggest that the eastern main area has a slightly higher residual particulate burden than the other areas of the office.



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RECOMMENDATIONS

The following limited recommendations are made based upon the results of the indoor air quality assessment that was conducted in the first level office spaces at the Placerville Masonic Center located at 471 Pierroz Road in Placerville, California.

1. The water-stained ceiling tiles in the office areas should be removed and replaced and the new tiles should be routinely inspected for any re-occurrence of water staining. If water staining begins to re-develop, the ceiling area should be inspected to determine the specific cause(s) of the water leakage and appropriate repairs should be made to prevent further leakage.
2. The outside air booster fans in the mechanical closets for HVAC Units #5 and #6 should be evaluated by a qualified ventilation contractor to ensure that they are working properly.
3. The return air plenum area beneath HVAC Unit #6 should be cleaned.
4. The carpeting throughout the office spaces should be thoroughly cleaned (hot water extraction) or removed and replaced.

Attachments:

Table 1
Laboratory Report

TABLE 1
PARTICLE CHARACTERIZATION AIR SAMPLING RESULTS
 471 Pierroz Road
 Placerville, California

Sample Location	Outdoor, Front	Eastern Main Area	Central Main Area	Western Main Area
Sample Identification	471-05	471-06	471-07	471-08
Sample Period	1306 – 1314	1309 – 1317	1318 – 1326	1344 – 1354
SAMPLE RESULTS (C/M³)				
Mold Spores				
Ascospores (majority tiny, hyaline)	789	171	—	—
Basidiospores (majority tiny, hyaline)	2,160	34	103	137
Cladosporium	—	137	—	27
Drechslera/Bipolaris	8	—	—	—
Oidium/Peronospora	34	—	—	—
Other Hyaline (majority tiny, hyaline)	274	—	—	27
Other Brown Fungi	—	34	34	—
<i>Total Mold Spores</i>	3,265	377	137	192
Hyphae Fragments	343	69	34	—
Algal Spores	69	—	—	—
Insect Parts	—	8	—	—
Pollen				
<i>Total</i>	480	8	8	—
Miscellaneous Aerosols				
Skin cell fragments	240	13,029	4,586	2,907
Cellulosic fibers	239	477	255	138
Opaque particles	7,087	9,771	4,286	1,920

Note: Only those particles that were detected in one or more samples are included in this table.

— = Not detected

C/M³ = Counts per cubic meter of air

Detection Limits = Mold Spores/Aerosols 27 C/M³; Pollen 7 C/M³.

ENVIRONMENTAL AIRBORNE AEROSOL ANALYSIS

Client Name: Geomatrix Consultants, Inc.
 Client Project #: EDC-471
 EAA Project #: O8-Q253

Project Desc: Co of El Dorado
 Date Collected: 4/1/2008

Client Sample #	Sample Description / Location	Analysis Comments
471-05	Outdoors	Low debris & skin cell fragments. Moderate opaque particles & mold.
471-06	Main East	Moderate opaque particles & skin cell fragments. Low debris & mold. *
471-07	Main Central	Low debris, skin cell fragments, opaque particles & mold.
471-08	Main West	Low debris, skin cell fragments, opaque particles & mold.

AIRBORNE MOLD SPORE CONCENTRATIONS (Cts./m ³) - Spore Trap Sample Analysis					
Category	Sample #→	471-05	471-06	471-07	471-08
Total Mold Spores (Cts/m³)		3265	377	137	192
Alternaria					
Aspergillus/Penicillium-types					
Aureobasidium/Hormonema					
Ascospores (majority tiny, hyaline)		789	171		
Basidiospores (majority tiny, hyaline)		2160	34	103	137
Botrytis					
Chaetomium					
Cladosporium			137		27
Curvularia					
Drechslera/Bipolaris		8			
Epicoccum					
Fusarium					
Nigrospora					
Oidium/Peronospora		34			
Pithomyces					
Rusts					
Smuts/Myxomycetes					
Stachybotrys					
Stemphylium					
Torula					
Ulocladium					
Other Hyaline (majority tiny, hyaline)		274			27
Other Brown Fungi			34	34	
Small Brown Round					
Hyphae fragments		343	69	34	
Algal spores		69			
Fern spores					
Insect parts					
			8		
POLLEN (Total Cts/m³)		480	8	8	Not detected
not specified		480	8	8	
OTHER AEROSOLS (Cts/m³)					
Skin cell fragments		240	13029	4586	2907
Mineral wool-like					
Cellulosic fibers		239	477	255	138
Opaque particles		7087	9771	4286	1920
Other					
Statistical Parameters					
Vol. analyzed (m ³)—mold/aerosols:		0.029	0.029	0.029	0.036
Detect limit(Cts/m ³)—molds/aerosols:		34	34	34	27
% Sample analyzed—mold/aerosols:		24%	24%	24%	24%
Volume analyzed(m ³)—pollen:		0.120	0.120	0.120	0.150
Detection limit (Cts/m ³)—pollen		8	8	8	7
Sample flow rate (lpm):		15.00	15.00	15.00	15.00
Sample trace length (mm):		14.40	14.40	14.40	14.40
Microscope field diameter (mm):		0.350	0.350	0.350	0.350

Outdoor mold ranges are based on So. California data. Other areas may vary.

Some detection limits for particle categories may be higher or lower than reported when EAA stopping rules or different magnifications are applied

* Biogenic-like debris predominant debris.

Analyst: Éliane Coss

Date: 04/03/2008

