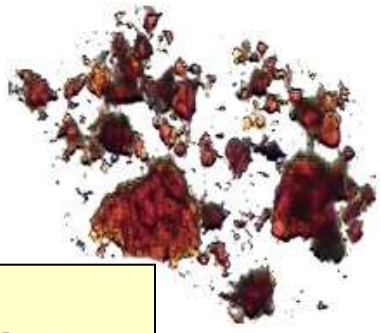


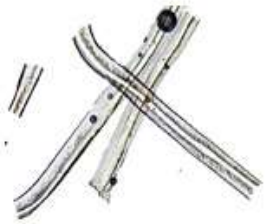


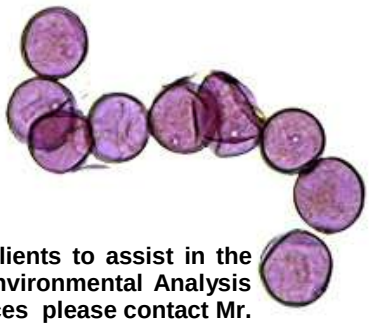
AIR-O-CELL METHOD INTERPRETATION GUIDE



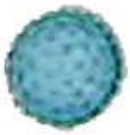

Environmental Analysis Associates

January, 2011





This guide is provided as general information to our clients to assist in the interpretation of the laboratory analysis provided by Environmental Analysis Associates, Inc. For information regarding testing services please contact Mr. Dan Baxter at:



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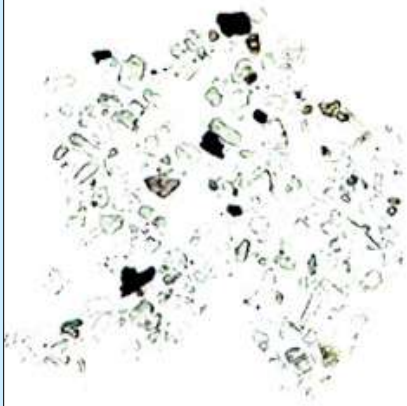


INTRODUCTION

Daniel M. Baxter

Environmental Analysis Associates, Inc. is one of few environmental consulting and laboratory testing firms in the country with the both the field and laboratory experience to provide diagnostic testing by Optical and Electron Microscoy and interpretation of common indoor aerosols and bioaerosols. Unlike other laboratories, EAA is an environmental consulting lab with comprehensive expertise in laboratory testing, field sampling design, research and development, failure analysis, and can routinely provide expert witness support. Mr. Daniel Baxter is the owner of EAA and inventor of the Air-O-Cell, the most widely used bioaerosol sampler in the country.

The goal of this guide is to provide our clients background information and testing support to assist in the location of potential sources of indoor air quality problems associated with aerosols and bioaerosols such as mold spores, fiberglass fibers, and shedding of building components.

The Environmental Analysis Associates, Inc. Optical Microscopy bioaerosol report is designed to assist in the evaluation and location of indoor air quality problems associated with mold and fungi, and other airborne aerosols found in the indoor environment. Utilization of data contained within the report requires proper guidance. It is important to note that standards for airborne aerosols covered in this document do not currently exist. The data should be used as a “screening” tool to separate the difference between typical and atypical indoor dust conditions and not as criteria for declaring an environment "safe" or "unsafe". This document (combined with the analysis report provided by EAA) should be used as a secondary information to supplement an onsite visual inspection.

The spore trap impaction sampling and microscopic analysis method employed in this report is based on a procedure that has commonly been used over the past 30 years for the evaluation of airborne aero-allergens, specifically mold and pollen grains. Although the resulting data cannot be directly compared with Andersen or other culture plate sampling techniques commonly employed in industrial hygiene investigations, both methods have advantages and limitations and should be employed together when medical symptoms are alleged so that the full range of mold and bacteria analysis can be performed.

Although it is often not possible for the analyst to precisely identify the particle, or specific emission source by analyzing the air sample alone, alerting a client when an “atypical” concentration of a specific particle category is present can help identify and locate a potential contamination source.

Identification and classification procedures require the use of both bright field (BF) and polarized Light Microscopy (PLM). Analysis of biological constituents rely primarily on the use of bright field microscopy. Analysis of inorganic constituents and fibrous materials requires the laboratory analyst to use both bright field and Polarized Light Microscopy. With the addition of the Air-O-Cell CSI cassette to the line of sampling products now in commercial use, additional analysis by Scanning Electron Microscopy and Energy Dispersive X-ray analysis can now be performed. This expansion of capabilities now allows the analysis of mineral and non-biologic particles that do not have definitive optical identification properties.

THE EAA PARTICLE CLASSIFICATION SYSTEM

The EAA Particle Classification System uses a combination of morphology and optical properties to classify particles. In some cases the classification may not accurately represent the exact identity of an individual particle.

Mold Spores	Spores generated from fungal material
Algal spores	Chlorophyll producing spores or filaments generated from plant material classified as algae
Fern spores	The spores generated by the botanical fern classification. These spores are most often transparent golden brown in color with an irregular surface.
Skin Cell Fragments (Dander)	Skin cell fragments generated by human or animals
Fibrous glass fibers (Isotropic)	Fibrous transparent glass fibers (fiberglass & mineral wool) used primarily as insulation materials and fillers in ceiling tiles.
Cellulosic fibers Cellulose fibers (Anisotropic)	Natural cellulosic fibrous materials used as clothing, paper products, etc.
Synthetic fibers (nylon, etc.)	Synthetic fibrous materials used as clothing, and finish materials including fabrics, carpeting, etc. such as rayon or nylon.
Opaque particles	Particles that are dark brown or black in color or are optically opaque and appear black with transmitted light.
Insect Parts	All particle debris associated with insects including leg parts, wing scales, and body fragments
Anthropogenic Particles	When significant concentrations of other types of particles are present in concentrations above approximately 5% of the particle distribution, they should be quantified in the "other" or mineral particle category.

MOLD & FUNGI

Elevated mold spore concentrations in both the indoor and outdoor environment are known to cause of allergy symptoms and occasionally responsible for respiratory illness in immuno-compromised individuals. Elevated mold spore concentrations in the indoor environment can be from outdoor infiltration; or from indoor growth sources when elevated surface moisture and humidity exist for extended periods of time.

Conditions under which indoor mold growth can occur include:

- Historical flooding without proper cleanup
- Moisture intrusion occurring through sub-flooring, walls, windows, or roofs
- Plumbing, water line leak, toilet overflows or sewer backups
- Moisture condensation within HVAC systems
- Persistent elevated relative humidity above 70%, and inadequate housekeeping

Ecology of molds and fungi:

Mold and fungi require three basic criteria to colonize the inside of a building including:

- A source of moisture
- A food source
- Lack of surface disturbance and/or air movement

Moisture sources in buildings occur most commonly as water and/or sewer leaks, moisture intrusion through walls and foundations, or as condensation around windows or in HVAC systems. In some parts of country such as the Southeast U.S. for example, the relative humidity during certain times of the year is high enough to act as a significant moisture source alone.

Indoor food sources for mold can be any organic material provided by a flood or sewer backup; or cellulosic materials present in the building such as carpet backing, linoleum backing, drywall paper, ceiling panels, or the buildup of plant and/or skin cell fragments or debris on inorganic surfaces. Skin cell fragments are a significant food and colonizing source in office buildings and private homes where a high occupancy exists, or adequate housekeeping is not performed.

Molds colonize most readily where air disturbance is minimal. For this reason, mold colonization occurs most frequently in closed or concealed spaces such as closets, storerooms, basements, refrigeration units; or on the back or underside surface of furniture.

MOLD & FUNGI

Potential health effects from inhalation of mold and fungal spores:

At present, it is generally accepted in the medical community that exposure to mold may result in symptoms consistent with a cold, flu, allergy hay fever, or asthma in some people. Others have no symptoms at all. It is also generally accepted that there are no long term or permanent health effects from exposure to mold once the occupant is removed from the property. It is also generally recognized in the medical community, that those who are known to be allergic to molds and those with asthma mayhave a higher risk of allergic reactions and should take extra precautions when in such situations.

Outdoor assemblage of molds:

Outdoor assemblages of mold spores are most commonly populated with over 90% of the following spores (listed in approximate order of descending abundance):

- Cladosporium
- Mushroom-like fungi (Ascospores and Basidiospores)
- Alternaria
- Rusts and Smuts (colonizing primary flower and leaf parts)
- Aspergillus & Penicillium (soil and moist cellulosic surfaces).

All of the above mentioned spores colonize decaying vegetation and/or soil.

Indoor Assemblage of Molds:

The most common molds susceptible to indoor amplification (over 90% of the typical mold growth) in approximate order of descending abundance include:

- Penicillium
- Aspergillus (flavus, fumigatus, terrus, versicolor, niger)
- Cladosporium
- Stachybotrys
- Alternaria, Chaetomium
- Zygomycetes (Mucor & Rhizopus)
- Ulocladum, Trichoderma
- Basidiomycete fungi

MOLD & FUNGI

When moisture intrusion becomes chronic and/or involves sewage contamination, tertiary mold growth such as Stachybotrys, Chaetomium, and Ulocladum may become common along with increased concentrations of bacteria. Chronic moisture can also initiate the colonization of wood destroying fungi. Over time, these kinds of fungi will colonize and destroy structural wood components of a building and can result in very high indoor airborne basidiospore concentrations.

Interpretation of Mold Spore Concentrations:

A high variability in outdoor mold spore concentrations and distribution exists on a daily to hourly basis and is dependent on local vegetation and micro-climate, the time of year, local weather patterns, and diurnal variation. As a result, caution must be used when simultaneously comparing limited data sets of inside and outside concentrations or over generalizing any set of data. Tables given below can serve as a guide to evaluating the relative degree of indoor airborne mold spore amplification.

Typical Outdoor Mold Spore Concentration Ranges

Description	Spores (cts/m^3)	Predominant Types *
Arid / desert regions	50 – 5,000	Cladosporium, asco/basidospores Alternaria, Penicillium, Aspergillus
Urban & coastal strip	200 - 10,000	Cladosporium, asco/basidospores Alternaria, Penicillium, Aspergillus
Inland valley & native vegetation	500 - 20,000	Cladosporium, asco/basidiospores Penicillium, Aspergillus
Farms & heavy forestation	5,000 - 50,000	Cladosporium,asco/basidiospores Alternaria, Penicillium, Aspergillus

•Genus/category listed in order of decreasing concentration frequency

Typical Indoor Mold Spore Concentration Ranges

Description	Spores (cts/m^3)	Predominant Types *
"Clean" building	less than 2,000	Total for all spore types
	less than 700	Penicillium, Aspergillus
Possible Indoor Amplification	1,000 - 5,000	Penicillium, Aspergillus, Cladosporium
Indoor Amplification likely present	5,000 - 10,000	Penicillium, Aspergillus, Cladosporium
Chronic Indoor Amplification	10,000 - 500,000	Penicillium, Aspergillus, Cladosporium
Inadequate flood cleanup or active Indoor demolition of contaminated surfaces	50,000 - 10,000,000	Penicillium, Aspergillus, Stachybotrys, Cladosporium, Chaetomium, Basiomycetes Tricoderma, Ulocladium, etc.

MOLD & FUNGI

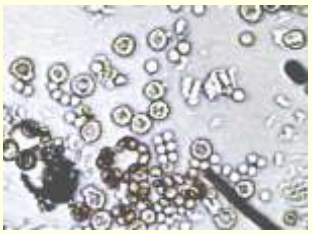
As a general rule, total indoor airborne spore concentrations in a typical clean HVAC supplied building are less than the "average" regional outside concentrations, and/or less than approximately 1,500 cts/m^3. Aspergillus /Penicillium and other hyaline spores are on average less than 700 cts/m^3. Indicator fungi such as Stachybotrys, Chaetomium, Ulocladium are often recovered in low concentrations in indoor samples as a result of normal infiltration, therefore, automatically assuming there is indoor growth when low concentrations of any indicator species are detected is inappropriate. Remember, there is always a likely exception to every rule or generalization, and because there is no direct relationship between simultaneously collected indoor and outdoor samples, performing a direct comparison with limited sampling is often be misleading. The range of expected variability (i.e. a factor of 5 to 10 fold differences) when comparing limited data sets must also be considered.

Examples photos of common airborne mold spores found indoors are given below:

Spores commonly associated with infiltration (in approximate decreasing frequency of occurrence)

Cladosporium

Ascospores



Pencillium/Aspergillus/hyaline

Alternaria

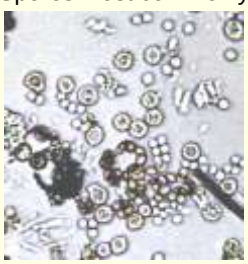
Bipolaris-like

Epiccocum

Curvularia

Smut-like

Spores most commonly associated with indoor growth (amplification)

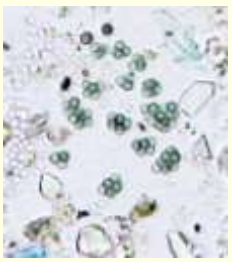


Penicillium/Aspergilus
Other hyaline spores

Stachybotrys

Chaetomium

Pithomyces & Ulocladium



Trichoderma-like

POLLEN

The presence of pollen in the indoor environment is almost always the result of air infiltration from the outdoor environment. In a typical HVAC supplied air building, airborne pollen concentrations will be very low (less than 10ct/m^3) or not detected at all. However, sensitive individuals can often mistakenly attribute complaints to the interior of a building that are actually the result of exterior pollen or other allergen sources. Often landscaping in building courtyards can also be a factor with perceived indoor problems. The time of year and the individuals home environment and pathway to work may also be significant factors to consider for potential exposure.

According to the literature, individual response to pollen is highly variable. Some individuals with pollen allergies may begin to exhibit symptoms when airborne concentrations exceed approximately 50 cts/m^3, especially with grass or highly allergenic pollen such as ragweed. The time of day when symptoms are pronounced is extremely critical for proper diagnosis. Because of the wide range and severity of pollen allergenicity, consultation with an Allergist may be warranted in the rare occasions when significant indoor pollen concentrations are encountered.

Pollen identification in the EAA analysis report are given as the genus when known, or as the taxonomic classification (i.e. inaperturate, triporate, tricolpate, etc.) when the pollen cannot be readily identified.

Typical Outdoor and Indoor Pollen Concentration Ranges

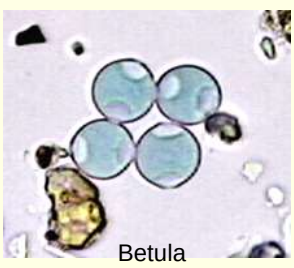
Description	Pollen grains (cts/m^3)	Predominant Types *
Outdoors - Urban & coastal strip	5 – 1,000	Dependent upon season and region
Outdoors - Native vegetation	10 - 5,000	Dependent upon season and region
Indoors (low)	ND – 30	Dependent upon season and region
Indoors (moderate)	30 – 100	Dependent upon season and region
Indoors (high)	> 100	Dependent upon season and region

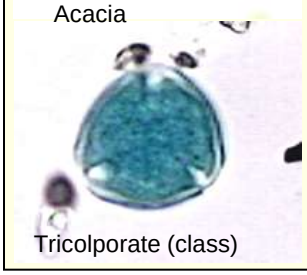
•Note: All concentrations refer to measurements obtained during the growing seasons reflecting local California data. Other regions could be higher or lower than approximate ranges given above.

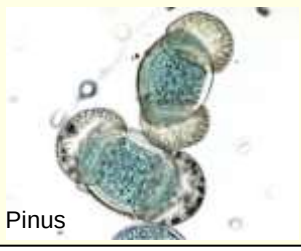

Acacia

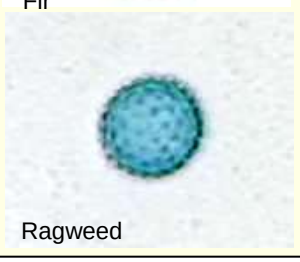

Grass


Fir


Betula


Tricolporate (class)


Pinus


Ragweed


Inaperturate (class)

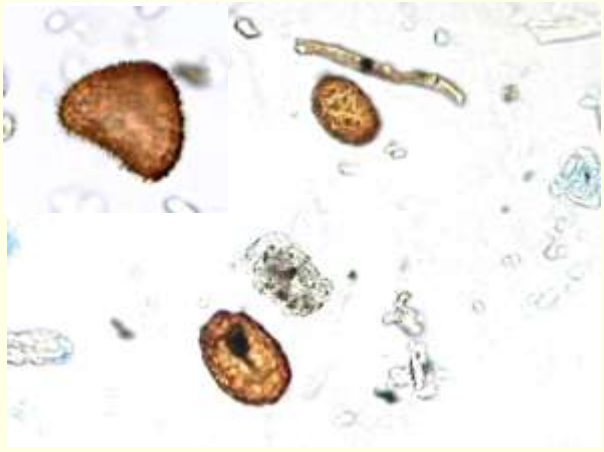
ALGAE AND FERN SPORES

When algal or fern spores (in wet climate areas) are detected in any concentration in "indoor" samples, a stagnant water source is likely present somewhere in proximity to the air intake stream. Although significant information is not readily available regarding health effects, algal are potential indicators of persistent moisture and other potential bacteriological or protozoa reservoirs.

Typical Airborne Algae and Fern Spore Concentration Ranges

DESCRIPTION		Cts/m^3
Outside air (depending on micro-climate	--	10 - 1,000
Inside air "clean Southern California building		ND - 50
Inside air “moderate"		50 - 200
Inside air "high "		> 200

Algae filaments & spores



Fern spores

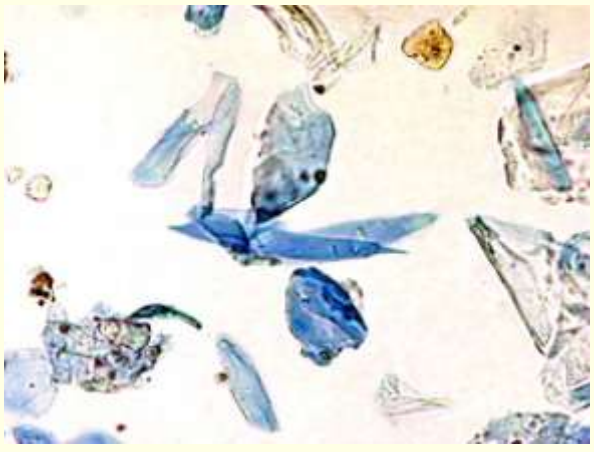
SKIN CELL FRAGMENTS

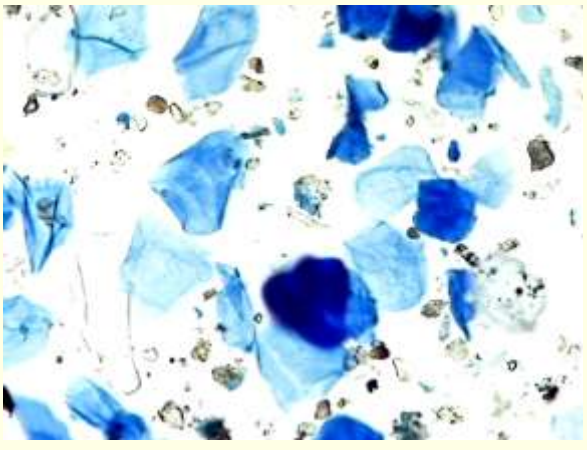
The skin cell fragment category includes skin cell fragment concentrations 20.0um in diameter. Dander or skin cell fragments are the most common and major source of particle debris in indoor samples. One of the biggest differences between "inside" and "outside" air quality is the concentration of airborne skin cell fragment concentrations, and human-borne contaminants (i.e bacteria, viruses) riding as passengers on skin tissue. Skin fragments often comprise over 50% of the "volume" of identifiable particles in indoor air. It is not possible in a microscopic analysis to differentiate human dander from animal or pet dander.

Although no direct health effects can be derived by their measurement, skin cell fragment concentrations are a good combined surrogate indicator of effective fresh air transfer rates, occupant density, commensal bacteria potential, house-keeping and cleaning practices, and filtration of recirculated air in the building. Typical concentrations encountered in buildings are given below.

Typical Airborne Skin Cell Fragment Concentration Ranges

DESCRIPTION	Cts/m^3
Outside air --	50 - 1,000
Inside air "clean building"	1,000 - 10,000
Inside air " high human activity"	10,000 - 20,000
Inside air "high personnel density and/or poor house-keeping"	20,000 - 100,000



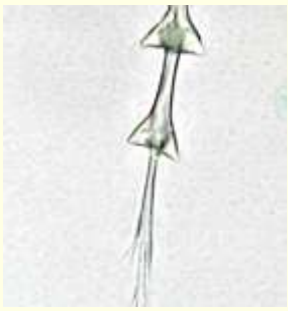


BIOLOGICAL, CELLULOSIC, & SYNTHETIC FIBERS

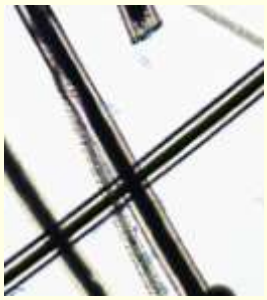
The cellulosic / synthetic fiber category covers a wide range of fibers that are commonly found in indoor samples. Airborne fibers in this category include biogenic (derived from biological activity) fibers, cellulosic fibers (derived from plants), and common synthetic fibers such as rayon, nylon, etc. Indoor fiber emission sources include architectural finishes, paper products, clothing, and carpeting, and are commonly found in airborne concentrations ranging from 100 to 1,000 cts/m^3. These fibers are for the most part are “anisotropic”, and produce a positive sign of elongation and will appear yellow when oriented nw / se, and blue when oriented ne / sw in the PLM microscope. Some synthetic fibers and monoclinic crystals appear yellow in both vibration directions, i.e., the sample light vibration in all directions. Biogenic fibers (shedding from biological sources (plant, insect, or animal) by themselves are not normally a cause of allergy or illness symptoms. Elevated biogenic fibers may be an indication of inadequate housekeeping ventilation, high biogenic sources, and or high occupancy rates.

Typical Airborne Cellulosic / Synthetic Fiber Concentration Ranges

DESCRIPTION	Cts/m^3
• Outside air -- (Usually plant fragments)	100 - 1,000
• Inside air "clean buildings” (Usually fabric and paper fragments)	100 - 1,000
• Inside air " high human activity"	1,000 -5,000
• Inside air "high personnel density and/or poor house-keeping"	5,000 - 50,000

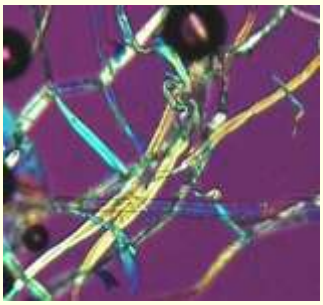


Down feather



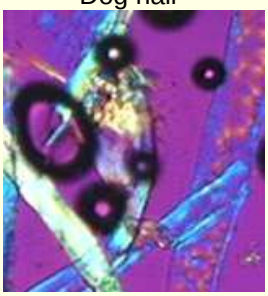
Dog hair

Spider web

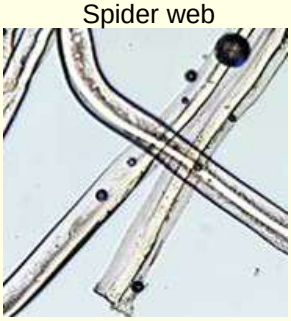


“Kleenex” tissue

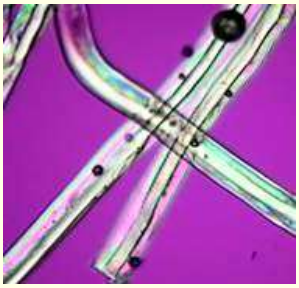
Cardboard box (BF)



(PLM / full wave)



Nylon carpet (BF)



(PLM / full wave)

FIBERGLASS FIBERS

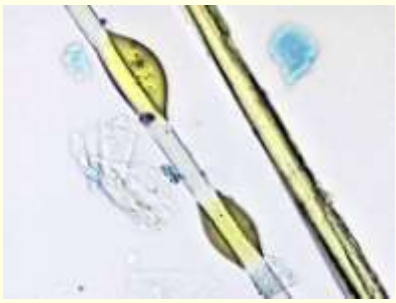
Airborne fiberglass fibers encountered in the indoor environment are most commonly composed of amorphous (non-crystalline) fibrous glass particles commonly known or identified in products as fiberglass or mineral wool. Fibrous glass sources may include ceiling tiles, debris from renovation projects, or the degradation of HVAC system sound liners. More importantly, airborne detection is a strong indicator of concurrent surface contamination and the potential for skin or eye contact irritation.

Because “fiberglass” and “mineral wool” are manufactured by different processes, they are morphologically different. Fiberglass fibers are uniform along the entire width of the fiber, while “mineral wool” is characterized by non-uniform width and the presence of bulbous and rounded ends. Both categories of fibers are “isotropic” and by definition the refractive index does not change with orientation. As a result, fiberglass fibers when viewed in cross-polarized light become invisible without the use of a retardation wave plate with the polarized light microscope. When a full wave retardation plate is inserted, these fibers will appear colorless in all orientations. The macroscopic coloration is due to the resin binder and not the color of the fiber.

Typical Airborne Fiberglass Concentration Ranges

DESCRIPTION	Cts/m^3
Outside air --	ND – 20
Inside air “low”	20 - 50
Inside air " moderate“	20 - 100
Inside air "high – building shedding likely"	> 100

Black soundliner fiberglass

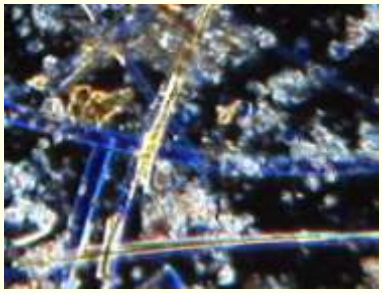


Yellow “batt” insulation

Pink “batt” insulation

Yellow duct wrap insulation

Mineral wool – ceiling tile



Fiberglass (PLM-dispersion staining)

OPAQUE PARTICLES

The opaque particle category encompasses a wide range of unrelated optically opaque particles including combustion emissions (primarily diesel), paint and binders from degrading sound liners in HVAC systems, biogenic debris (biological origin; i.e. insect droppings, decayed biological debris, etc.), and rust from HVAC components, rubber tire particles, and copier and printer toner. Specific identification of particle type usually requires additional sampling and analysis by Scanning Electron Microscopy (SEM). This category of particle does not normally occur in concentrations exceeding approximately 5,000 cts/m^3 in "clean" indoor environments unless an infiltration source (such as close proximity to roads or agriculture) is present. Identification of the particle origin is not always possible, however, should be investigated as a potential contributor to air quality complaints when airborne concentrations exceed 10,000 cts/m^3. Commonly occurring optically black / brown or opaque debris are generated from 3 general processes including biogenic decay, corrosion, and combustion. Biogenic opaque black or brown debris are generated from chemical, biological, or heat decomposition.

The most common outdoor sources are soil, vegetation, and automobile emissions. The most common indoor biogenic sources (degradation from biological decay) are decayed dander, plant fragments, and insect droppings. The most common non-biogenic sources are from the degradation of metal HVAC system components (rust/metal fragments), binders and coatings from insulation and architectural finishes, and combustion or heat generated degradation.

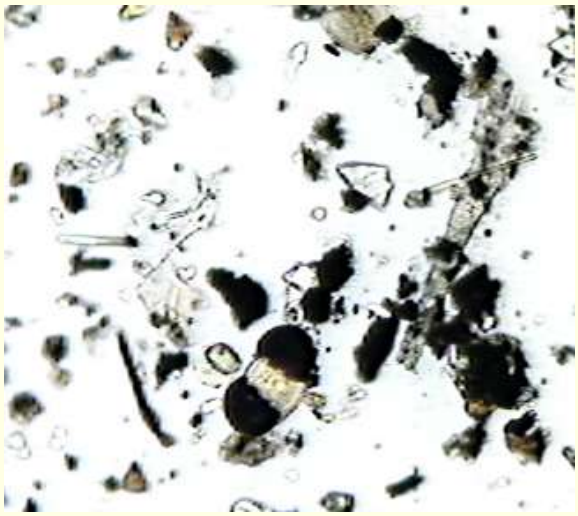
From a morphological standpoint, biologically derived opaque particles can often be separated from other types of opaque particles. In some cases opaque particles cannot be morphologically differentiated from corrosion shedding particles without using additional analysis by Scanning Electron Microscopy or chemical analysis.

Typical Airborne Opaque Particle Concentration Ranges

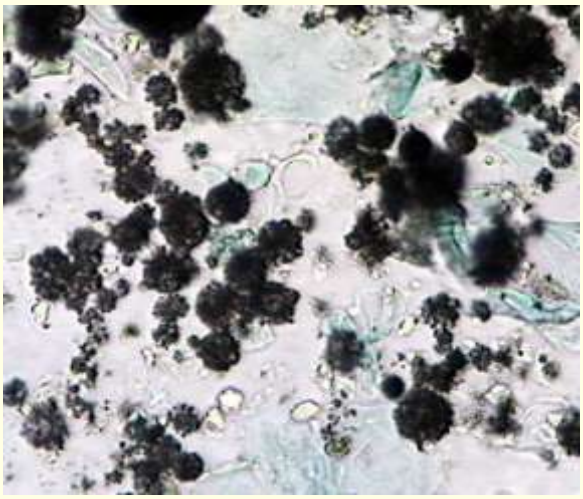
DESCRIPTION	Cts/m^3
Outside air -- (soil debris & auto exhaust)	500 - 10,000
Inside air “low”	500 - 5,000
Inside air " moderate“	5,000 - 10,000
Inside air "high – building shedding possible"	10,000 – 50,000
Inside air "high – building shedding likely”	> 50,000

OPAQUE PARTICLES (Primarily biogenic)

Biogenic opaque black or brown debris are derived from the chemical or biological decomposition of organically derived debris. The most common indoor sources are dander, plant fragments, insect droppings, etc. From a morphological standpoint, biologically derived opaque particles can often be separated from other types of opaque particles. Most biogenic debris have irregular, rounded, and "fuzzy" edge definition and lack the presence of straight particle edges, cleavage planes, or fracture marks. They also have a variability in optical density and will show an irregular variation in color and/or light transmission near the edge of the particle, as well as throughout the particle. Examples of high levels of biogenic derived debris (i.e. >100,000 cts/m^3) are below:

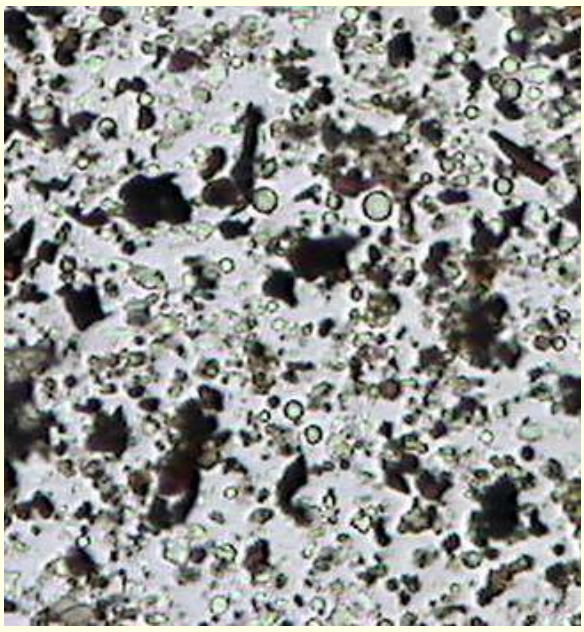


Outdoor plant/soil debris



HVAC duct residue

Decaying fungal debris



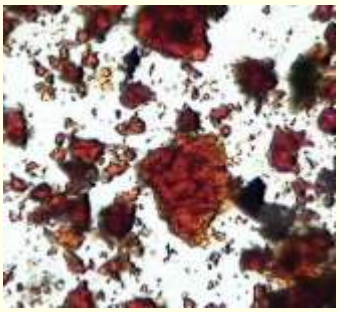
Floor sweepings from garage

OPAQUE PARTICLES (Non-biogenic)

Non-biogenic black or brown debris are derived from the chemical or physical degradation, corrosion, and shedding of mineral, resinous or film forming debris. The most common indoor sources are drip pan scale, rust, or pigments from coated metals or insulation. From a morphological standpoint, these types of opaque particles can often be separated from other sources of opaque particles.

- Most non-biogenic opaque debris have well defined, angular, and distinct edge definition and usuall have straight particle edges, cleavage planes, or fractures.

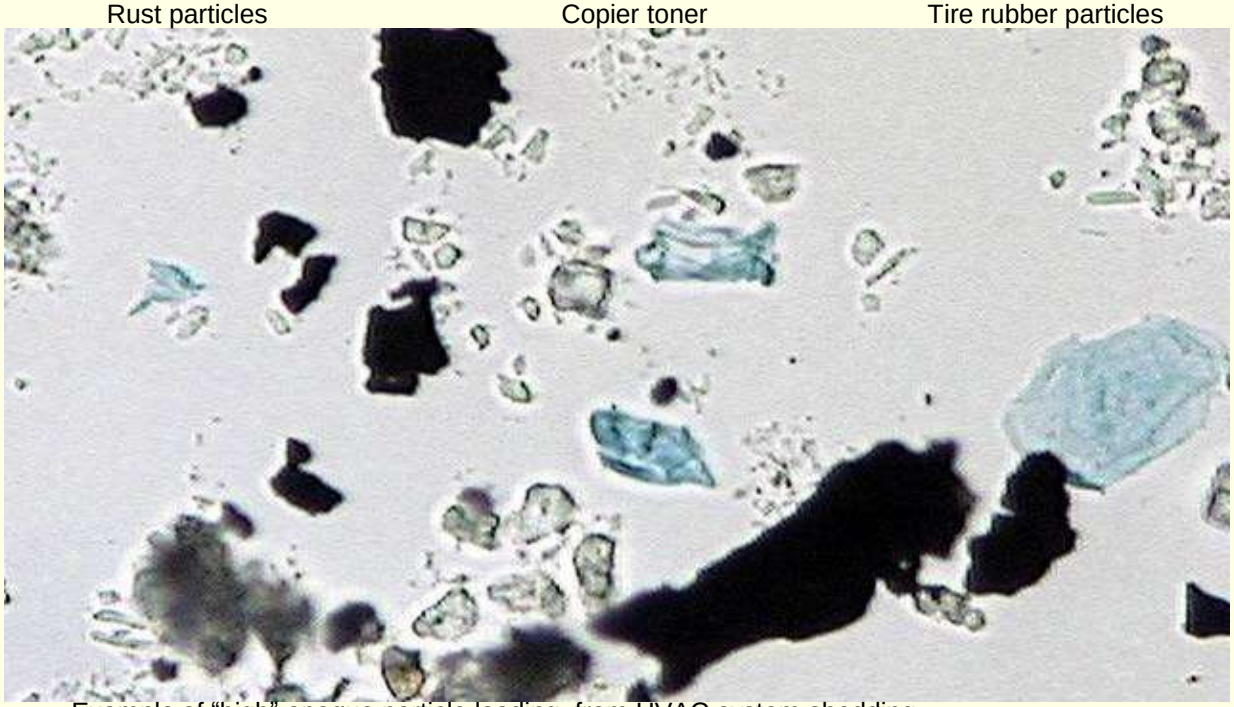
- Most non-biogenic opaque particles have a low variation in optical density (within the same particle thickness) and do not show a large gradational variation in color and/or light transmission near the edge or center of the particle.



Rust particles

Copier toner

Tire rubber particles



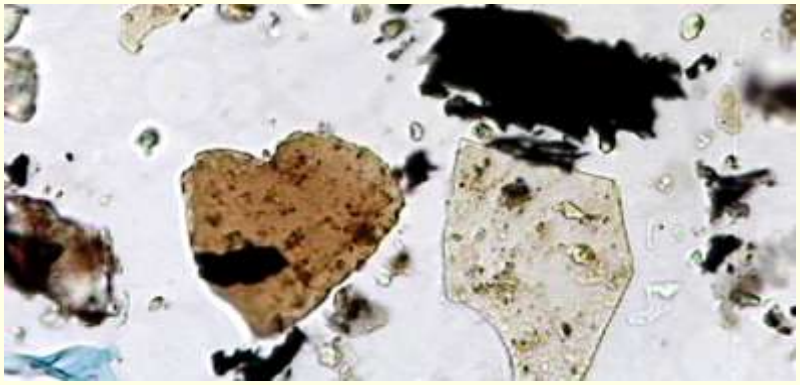
Example of “high” opaque particle loading from HVAC system shedding

OPAQUE PARTICLES (Combustion debris)

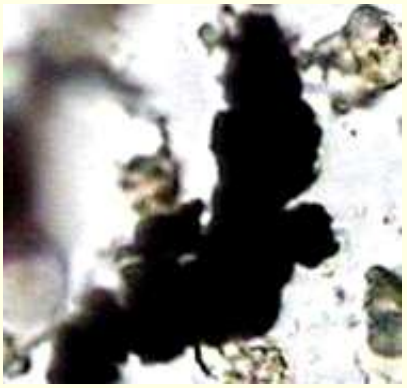
Opaque combustion debris are derived from the heating burning of cellulosic materials, hydrocarbons, or plastic residues. Angular and plate-like “Char” and “ash” particles are generated by the combustion of plant material from forest fires. The most common indoor sources include the infiltration of outdoor wood smoke or indoor fires. From a morphological standpoint, these types of opaque particles can be separated from other types of opaque particles based on their shape, morphology, and residual plant-like structure.

The combustion of fuel based organic material plastics, and plant resins produce small grape-like spheroidal particle chains with individual particles at the limit of resolution of the optical microscope.

When these types of particles are “fresh”, positive identification is more easily achieved. When combusted cellulose and aciniform particles are subjected to weathering and biodegration, it becomes more difficult to differentiate them from other “opaque” debris.



Forest fire soot (Cedar fire S. Cal.)



Wood soot

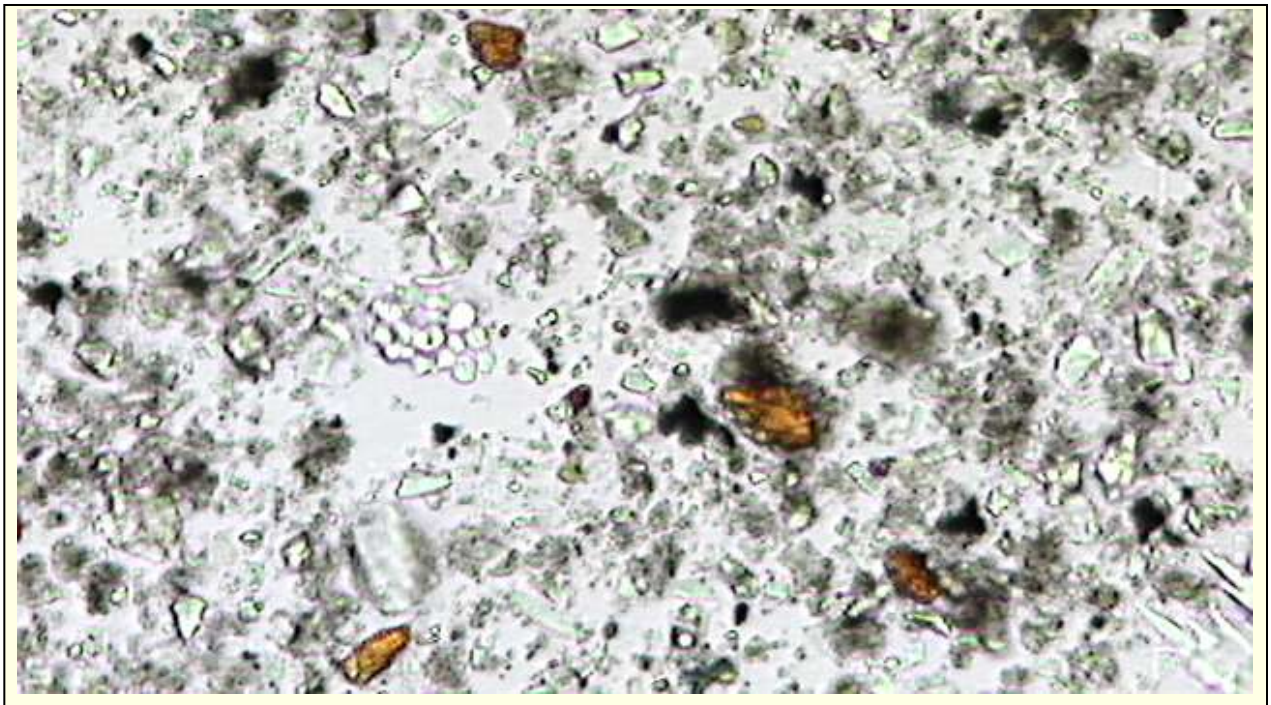
It is important to note, emissions from indoor fires are derived from a combination of cellulose sources, plastics, organic fuels, chemical compounds, and inorganic compounds. Indoor fires will produce a combination of cellulosic combustion particles and well as “aciniform” particles associated with hydrocarbon “combustion”. In addition, automobile emissions, especially diesel, produce “aciniform” particles.

Indoor fire soot (aciniform)

Diesel exhaust

OPAQUE PARTICLES (Partially open outdoor exposure)

Opaque debris derived from soil infiltration in partially enclosed areas such as roll-up door storage areas, warehouses, and crawl spaces. From a morphological standpoint, these types of opaque particles cannot be readily separated from other types of opaque particles .



Warehouse next to an agricultural field – Opaque particle concentrations 150,000 ct/m^3) – 800X

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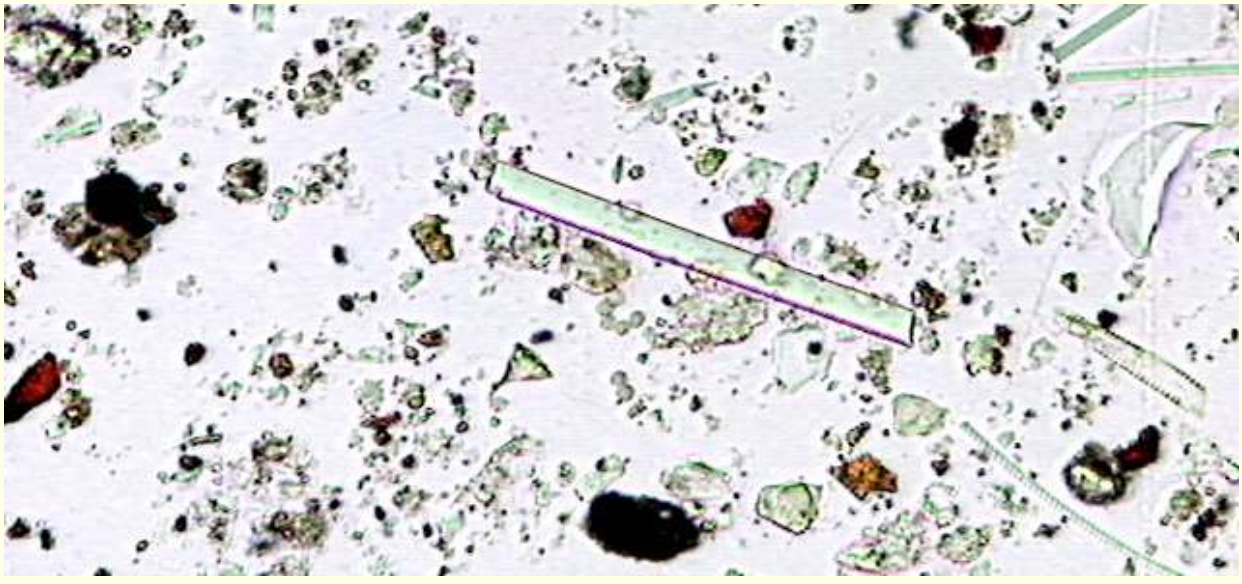


Mixture of rust & opaque particles (and mold spores) in construction debris – 800X

OTHER PARTICLES – Insect parts

Most of the “other” biogenic particles include insect parts (i.e. body parts, antennae, legs, scales, body hairs, and wing fragments. In "clean" indoor environments, airborne insect parts are routinely detected, however, moderate concentrations above ~100 cts/m^3 are not routinely measured. Quantities of wings scales, body parts, or droppings (>500 cts/m^3) may be an indicator of an infestation or simply inadequate building maintenance and/or air filtration. Occasionally dust mites are found in air samples when inadequate housekeeping or extensive mold growth is present. The presence of dust or carpet mites in airborne samples may indicative of an infestation.

Typical Airborne Insect Part Concentration Ranges

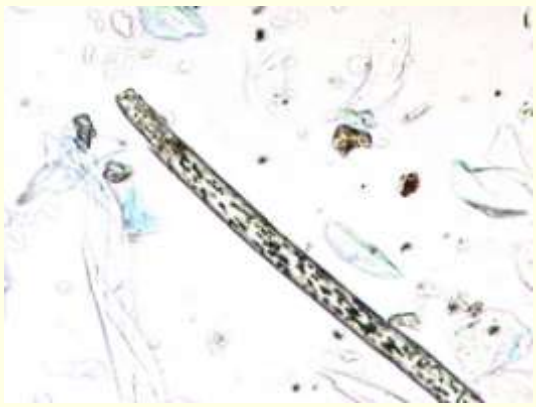
DESCRIPTION	Cts/m^3
Outside air --	ND – 500
Inside air “low”	< 50
Inside air " moderate“	50 -500
Inside air "high – building shedding likely"	> 500

Dust & carpet mites

Moth wing scale

Moth wing scale

Insect body hair



Insect body hair

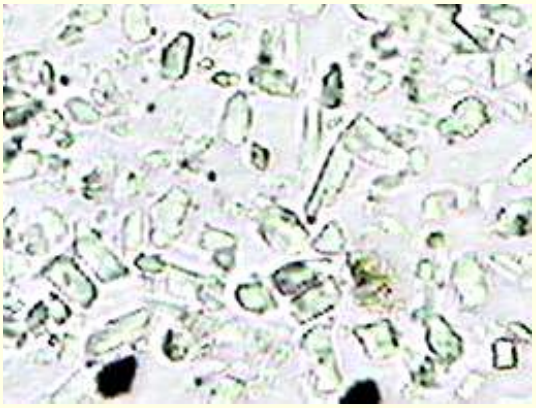
OTHER PARTICLES – Mineral Construction Debris

Elevated mineral construction debris particles are most commonly associated with renovation activities. They are composed mostly of carbonate and gypsum dust generated from the application and treatment of building components, drywall, patching compounds, and flooring adhesives. In "clean" indoor environments, airborne concentrations are typically less than 5,000 cts/m^3 and do not warrant routine measurement. However, when moderate concentrations are observed in each field of view during the analysis they should be reported as a general comment in regards to their presence and relative abundance (i.e. low, moderate, high).

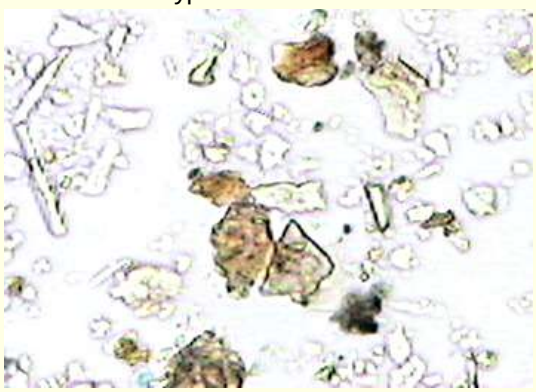
Typical Airborne Construction Debris Particle Concentration Ranges

DESCRIPTION	Cts/m^3
Outside air -- (expected range)	ND – 1,000
Inside air “low”	<5,000
Inside air " moderate“	~5,000 – 50,000
Inside air "high"	> 50,000

Gypcrete dust



Drywall dust

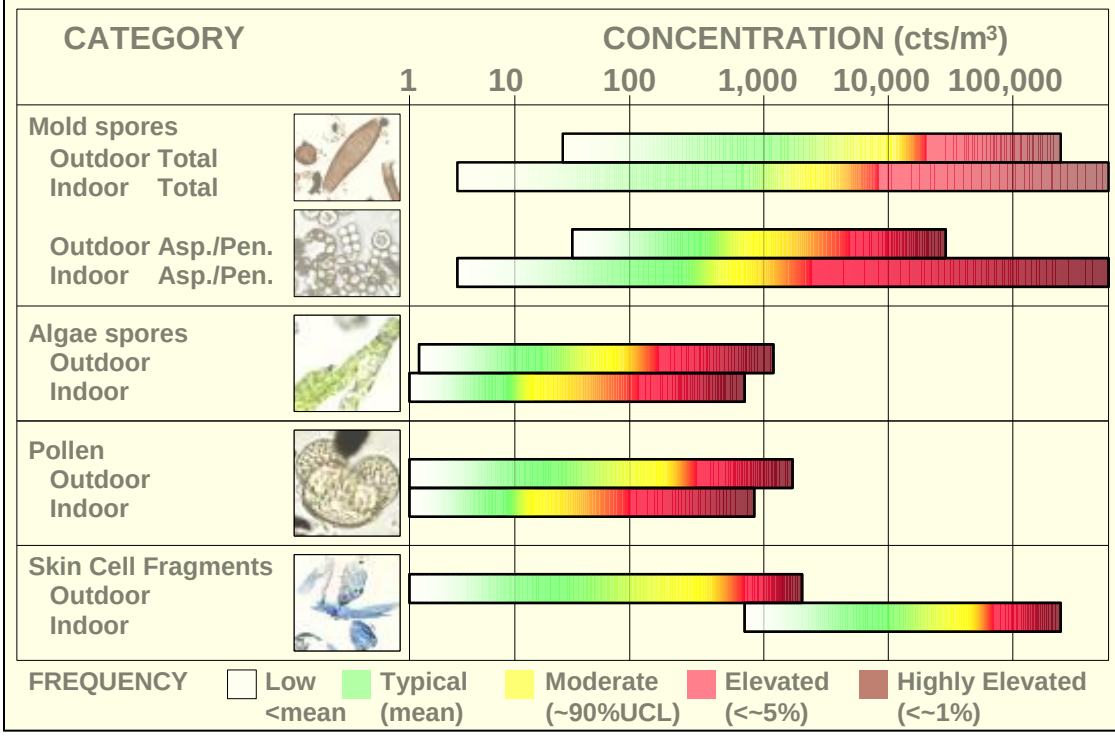


Soil dust

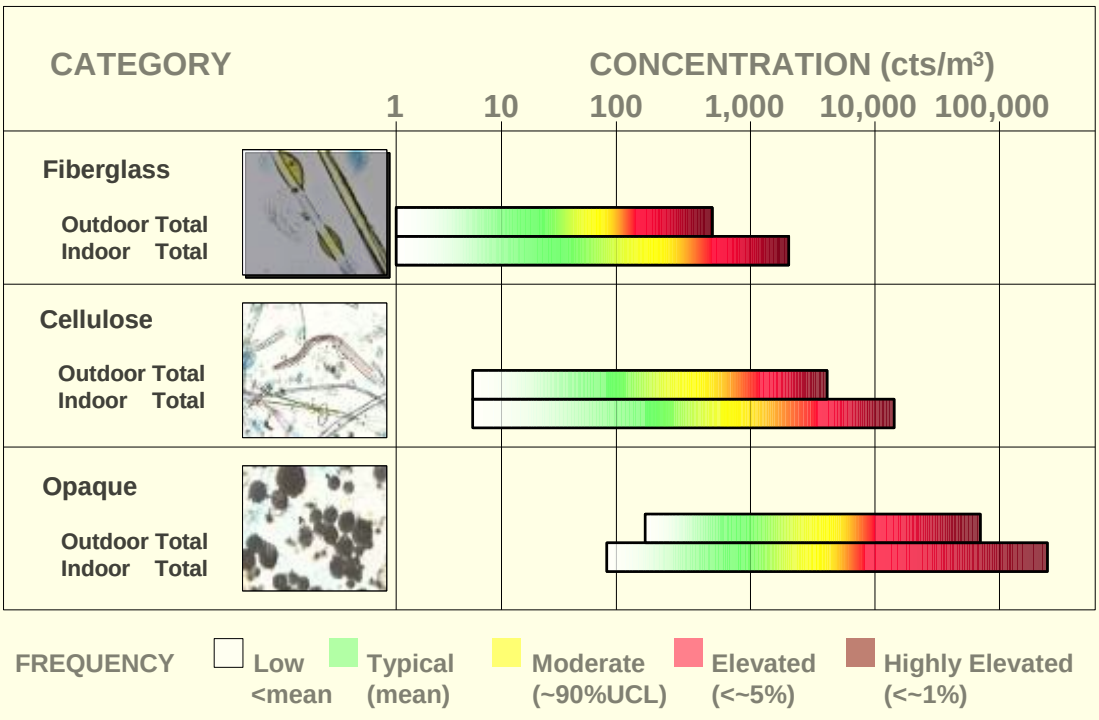
Diatomite

SUMMARY OF AIRBORNE PARTICLE CONCENTRATIONS

Bioaerosol Concentration Ranges (ct/m³)



Aerosol Concentrations Ranges (ct/m³)



ENVIRONMENTAL ANALYSIS ASSOCIATES, Inc. • 5290 Soledad Road • San Diego, CA 92109 • (858) 272-7747

ENVIRONMENTAL AIRBORNE AEROSOL ANALYSIS

Client Name : ABC Enterprises
Client Project # : 11-0500 Project : Office building #1
EAA Project# : 11-0796 Date Collected : 06/02/11

Client Sample#	Sample Description / Location	Analysis Comments
16494343	Outside air - front entrance	Moderate-high dust, pollen, and mold spore concentrations
16501748	Office 1	Moderate dust, low mold spore concentrations
16501752	Office 2	High dust & mold spore concentrations
16501756	Office 3	Moderate-high dust and "rust-like" opaque debris, low mold
16501767	Outside air - back entrance	High dust, soil debris, pollen, and mold spore concentrations

AIRBORNE MOLD SPORE CONCENTRATIONS (Cts./m^3) -- Spore Trap Sample Analysis

Category Sample # -->	16494343	16501748	16501752	16501756	16501767
Total Mold Spores (Cts/m^3)	**16937**	**837**	**13166**	**1166**	**43749**
Alternaria	137		206	69	274
Aspergillus/Penicillium	754		6720	754	1851
Aureobasidium pullans					
Ascospores	4663		411		14057
Basidiospores	3977	206	617		20640
Botrytis					
Chaetomium			343		206
Cladosporium	6034	411	2331	206	4663
Curvularia					
Drechslera/Bipolaris					69
Epicoccum					137
Fusarium					
Nigrospora					
Oidium/Peronospora					
Pithomyces					69
Rusts	343	14			274
Smuts / Myxomycetes	274	69			343
Stachybotrys			823		
Stemphylium	206				
Torula	69				206
Ulocladium					
Other Hyaline Fungi	137		1440	69	411
Other Fungi					
Unidentified Fungi	343	137	274	69	549
Hyphae fragments		274			
Algal spores					
Fern spores					
POLLEN (Total cts/m^3)	**600**	**27**	**53**	**13**	**933**
Not specified	200			13	67
Ambrosia (ragweed)	280		13		80
Gramineae (grass)	80				733
Pine / pine look-alikes	40	27	40		53
OTHER AEROSOLS (cts/m^3)					
Skin cell fragments	137	23314	14400	23314	137
Fiberglass / mineral wool		69	686	69	
Cellulosic fibers	343	2743	4457	2743	343
Opaque particles	21394	1646	7200	34697	34354
Statistical Parameters					
Vol. analyzed (m^3)--mold/aerosols:	0.015	0.015	0.015	0.015	0.015
Detect limit(Cts/m^3)--mold/aerosols:	68.6	68.6	68.6	68.6	68.6
% sample analyzed--mold / aerosols:	19%	19%	19%	19%	19%
Volume analyzed (m^3)--pollen:	0.075	0.075	0.075	0.075	0.075
Detection limit (Cts/m^3)--pollen:	13.3	13.3	13.3	13.3	13.3
Sample flow rate (lpm):	15.0	15.0	15.0	15.0	15.0
Sample trace length (mm):	14.40	14.40	14.40	14.40	14.40
Microscope field diameter (mm):	0.280	0.280	0.280	0.280	0.280

EXAMPLE AIRBORNE AEROSOL REPORT

Analyst review signature: Daniel M. Baxter Date: 6/5/2011