ENVIRONMENTAL ANALYSIS ASSOCIATES, INC.

AIRBORNE AND SURFACE DUST ANALYSIS INTERPRETATION GUIDE

2020-7

Now including updated percentile data for surface dust concentrations!

This document provides the clients of Environmental Analysis Associates, Inc. with suggested guidelines for interpreting our laboratory analysis reports. The suggested percentile classifications and numerical guidelines may not apply to samples analyzed by other laboratories, nor should they be used by themselves as an indicator of "contamination" or a safe or unsafe environment. For more information regarding testing services please contact Mr. Daniel M. Baxter at dbaxter@eaalab.com.

Environmental Analysis Associates, Inc.
Michigan Environmental Laboratory ***(AIHA-LAP, LLC. accredited)***
306 5th Street, Suite 200 Bay City, MI 48708
Phone: 989-895-4447
Email: dbaxter@eaalab.com
Website: eaalab.com

Environmental Analysis Associates, Inc.
California Forensic Materials Laboratory
5290 Soledad Road, San Diego, CA 92109
Phone: 858-272-7747
Email: dbaxter@eaalab.com
Website: eaalab.com

APPROPRIATE USE OF THE AIR PROFILE GUIDELINES

AIR PROFILE ™

IMPORTANT : Providing hazard communication, or making recommendations for remedial action should always first be based on a thorough visual inspection and the professional judgement of a trained environmental professional. The suggested terminology and exposure evaluation criteria given below specifically addresses the statistical comparison of individual samples with the airborne percentile concentration ranges measured within our database of occupied buildings. It does not take into account the critical observational data that is required to render an accurate and complete exposure assessment for any specific building. In other words, the percentile ranges and descriptive terminology cannot directly be used as the sole criteria to infer a “safe”, "unsafe", or “elevated" condition is present.

The ***AIR PROFILE***™ and ***DUST PROFILE***™ Guidelines are intended to be used as a diagnostic tool to 1). Help the investigator identify and obtain a profile of potential mold and/or dust conditions that are not readily observable, 2). Use the resulting quantified assemblages to determine the potential origin of “atypical” contamination levels, and 3). Compare and classify the measured levels found inside a specific building with a database collected from other buildings using industry accepted methods.

Since "hazard" levels or permissible exposure limits (PEL's) are not available for mold and other types of common dust particles, the terminology commonly used for exposure assessment, e.g. "acceptable" "uncertain", and "unacceptable", are not directly applicable. Although our past use of the classifications of "Low", “Moderate”, "High", etc. were clearly defined, and make logical sense for statistical comparison purposes, these terms have been misused by investigators and litigation professionals as having a direct safety or "contamination" implication, which they do not. Recent feedback from exposure assessment professionals has encouraged us to clarify the language describing the statistical percentile frequency classifications. These changes should help better define the appropriate interpretation of sample results provided by Environmental Analysis (EAA).

EAA now uses the terminology of "Typical", "Atypical", and “Elevated“ to define the concentration ranges as compared to our nationwide database. The classifications are still divided into the same six (6) ranges (representing the <50th, >50th, >75th, >90th, >95th, and >99th percentiles respectively) to interpret both airborne and surface concentration data.

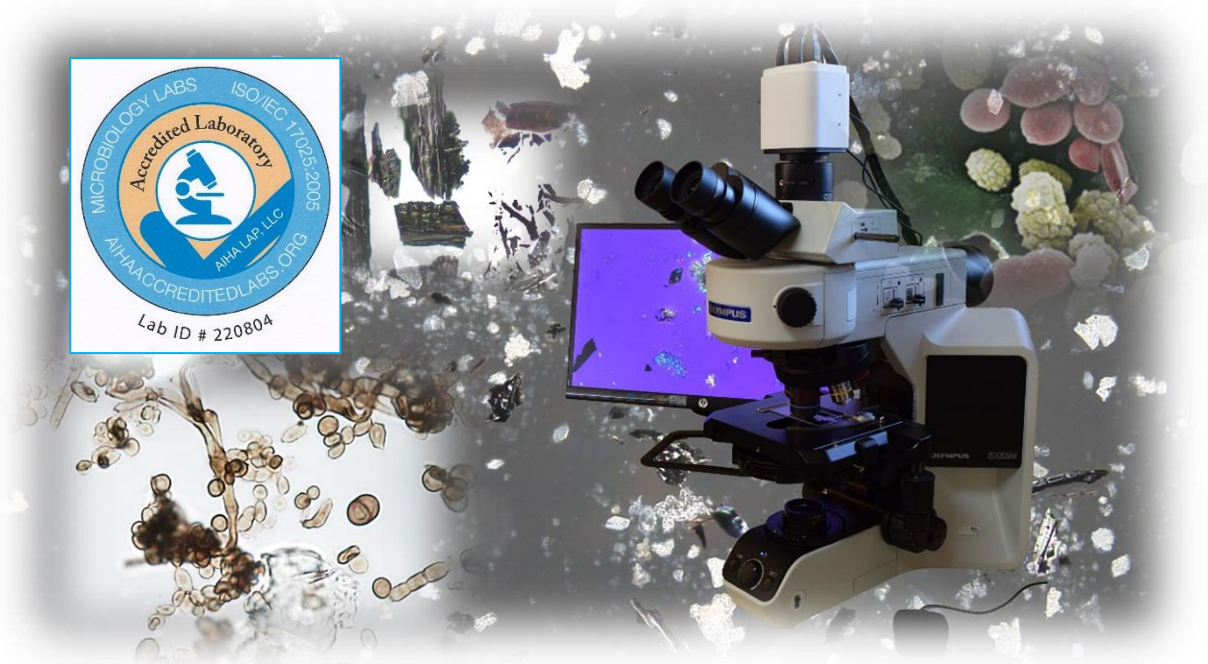
The categories have two (2) levels for each descriptive percentile classification, and are defined and color-coded as follows:

Typical - 1	Measured frequency of less than the 50th percentile - typically found in clean or low impact buildings.
Typical - 2	Measured frequency between the 50th and 75th percentile - typically found in “average” or typical buildings.
Atypical - 3	Measured frequency between the 75th and 90th percentile - found marginally above typical buildings.
Atypical - 4	Measured frequency of between the 90th and 95th - percentile found in buildings with atypical dust levels.
Elevated - 5	Measured frequency between the 95th and 99th - found in buildings with elevated exposure levels.
Elevated – 6	Measured frequency exceeding the 99th percentile - found in buildings with significantly elevated exposure levels.

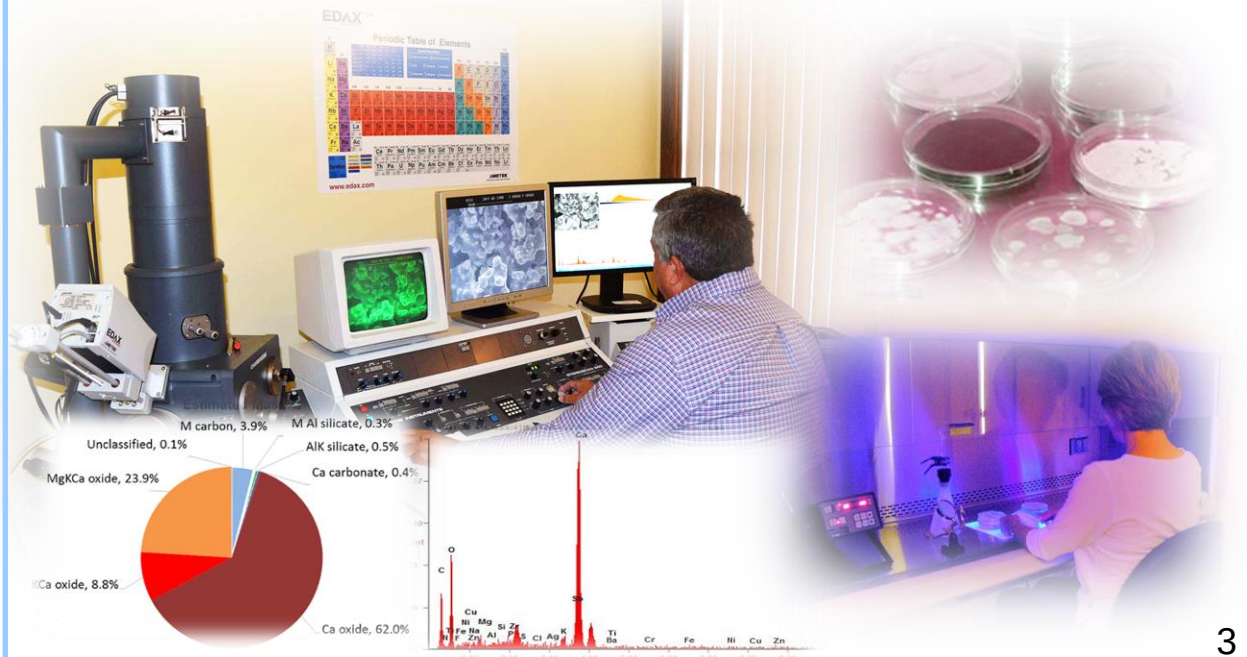
CONSULTING & TESTING SERVICES

Environmental Analysis Associates, Inc. is dedicated to providing state-of-the-art indoor air quality particle testing services using an integrated system of Optical Microscopy and automated Scanning Electron Microscopy analysis methods. When combined with our 30 years of field and consulting experience, we can fully support our clients in finding the source and solution to dust-related indoor air quality complaints.

The Michigan Environmental Laboratory is AIHA-LAP accredited for mold analysis and specializes in the analysis of all types of surface and airborne mold, dust, and fire / combustion residue.



The California Forensic Materials Laboratory specializes in trace particle analysis, product defect and failure analysis testing, and litigation support.



INTERPRETATION GUIDE BACKGROUND

AIR PROFILE ™

Airborne and Surface Dust Analysis Using Optical Microscopy and Scanning Electron Microscopy

This updated Version 7 of the method guide is based on our nationwide database of over 3,500 indoor and 1,000 outdoor airborne Air-O-Cell dust samples collected between 2017 and 2018. A statistical summary of this data is available as a separate document upon request. This guide now also provides statistical percentile comparison levels for surface dust concentrations based on over 700 samples collected nationwide. The percentile levels for surface dust concentrations are incorporated into the ***DUST PROFILE***™ color-coded tables described on page 13.

EAA is one of only a few environmental testing laboratories in the country specializing in comprehensive dust and airborne aerosol testing using the full range of Optical and Scanning Electron Microscopy methods. Our historical investigation and consulting expertise also helps us provide you with knowledgeable support and data interpretation specific to your indoor air quality problems. Mr. Daniel Baxter is the owner of EAA, and inventor of the Air-O-Cell®, the most widely used airborne mold and dust sampler in the country.

The guide provides practical and industry accepted statistical comparison guidelines for the interpretation of indoor dust samples using Optical Microscopy methods. The EAA ***AIR PROFILE***™ Optical Microscopy color-coded guidelines and report data summary tables are based on this nationwide database. The guidelines allow direct comparisons of indoor airborne mold and other dust particle results from one building with a historical database from other buildings. These guidelines are based on airborne sampling data collected with the Air-O-Cell® slit impaction sampler, and surface adhesive tape lift sampling using the Zefon Bio-tape® media or cellophane tape. EAA has systematically classified and quantified the most commonly occurring particle categories found both indoors and outdoors.

The EAA ***AIR PROFILE***™ guidelines may not apply to samples analyzed by other laboratories or collected using other sampling devices. Since industry accepted exposure levels for mold or other particles classified in the EAA reports do not currently exist, the data should be used as a "screening" tool to determine the difference between typical and atypical indoor dust conditions. The data cannot be used as a basis for declaring safe, unsafe, or contaminated conditions; or as a substitute method to satisfy EPA, OSHA, or other governmental standards. The 1999 ACGIH document entitled *Bioaerosols Assessment and Control* uses the percentile frequency of occurrence as a comparison metric in "non-problem" buildings, and suggests that new data must exceed the 90th or 95th percentile to be considered indicative of a potential for harm. The EAA classification guidelines uses this same statistical method to classify and rank exposure. Specifically, the frequency of occurrence at the 50th, 75th, 90th, 95th, and 99th percentiles are used as the primary comparison criterion. The EAA guidelines and EAA analysis reports should be used as a secondary information to supplement an onsite visual inspection and industry accepted tests where they are applicable.

Although it is often not possible for the microscopist to precisely identify all particles or a specific emission source, identifying "atypical" particle ranges within a specific particle classification is the first step used to identify and locate a potential contamination source. Identification and classification procedures use the full range of Optical Microscopy methods including Transmitted Light Bright Field (BF), Polarized Light Microscopy (PLM), and Reflected Light/Dark Field Microscopy (RLDF). Samples can be further analyzed for their elemental chemistry and size distribution (when warranted) by automated Scanning Electron Microscopy. These new automated SEM/X-ray analysis procedures developed by EAA allow the precise chemical and size analysis of particle assemblages, and the identification of indoor contamination source(s). A flow diagram for comprehensive analysis is given on page 8 of this guide.

THE DIFFERENCE BETWEEN INDOOR AND OUTDOOR AIR

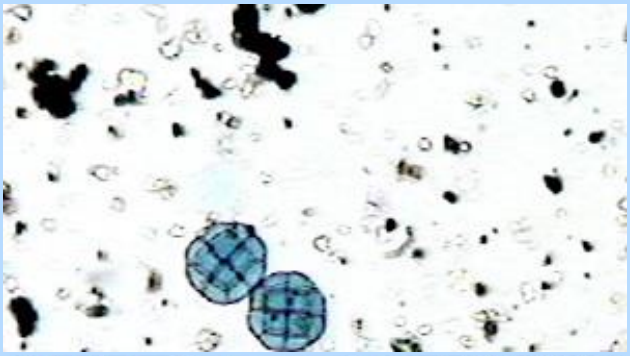
There are significant differences between the indoor and outdoor dust particle "***assemblages***". A dust particle "assemblage" is a grouping of different types of particles that are found in association with each other within defined types of environments, or when found together, may point to a specific source or environmental condition. Assemblage analysis is commonly used in archeology, and the dating of fossils or pollen. Until recently, it has not routinely been used as a systematic method to identify or quantify potential indoor air quality problems. For the most part, existing indoor air quality regulations address ventilation, and individual exposures to regulated toxic, irritant, or volatile chemicals or particles without evaluating their inter-relationship. These standard methods work well when there is a defined odor and/or known exposure hazard that has been identified. This approach is less successful when used to solve nebulous complaints associated with perceived irritation. In other words, if the particle type is not classified as hazardous or an irritant, even if the concentrations are exceedingly high, they are not routinely assessed or monitored by traditional EPA, OSHA, or ASTM methods. A systematic evaluation of the concentration and distribution of particles that are representative of the operational conditions of a building are usually helpful when standard or regulated material testing methods fail to resolve a complaint. EAA fills this testing gap by analyzing and profiling the difference in particle distributions generated by these varied operational conditions. The deviations in outside filtered air are often responsible for irritation or comfort complaints, or indicative of adverse building "shedding" conditions that can be identified and resolved. Several illustrative examples of different particle "assemblages" and their relationship to a building environment are given on the following two pages.

Outdoor air – rural / natural background profile

- *Vegetation particles*
- *Pollen*
- *Mold spores*
- *Soil/mineral particles*
- *Insect droppings*

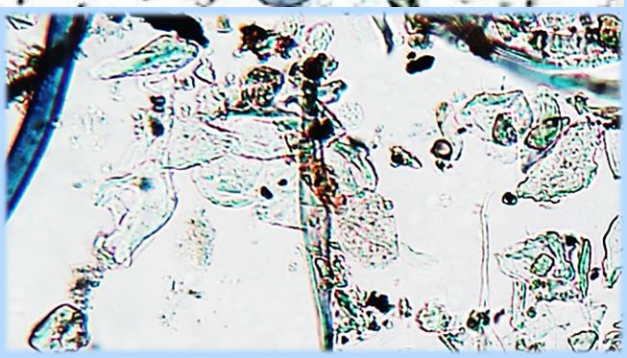
Outdoor air – city / urban / industrial profile

- *Outdoor air particles described above*
- *Road dust – asphalt & tire rubber*
- *Automotive combustion particles*



Indoor office & residential environment profile

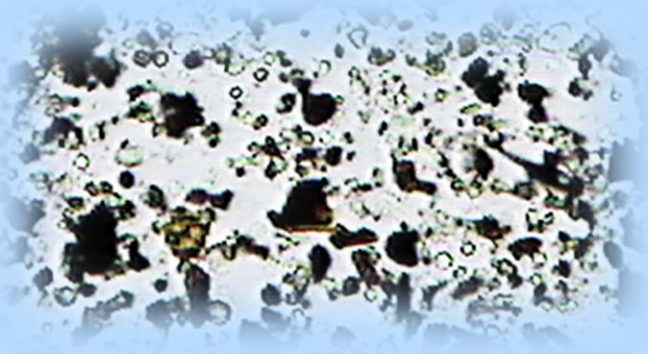
- *Primarily skin cells*
- *Clothing, furniture, & carpeting fibers*
- *Decayed biogenic debris*
- *Building generated HVAC & building materials*



THE INDOOR DUST ENVIRONMENT

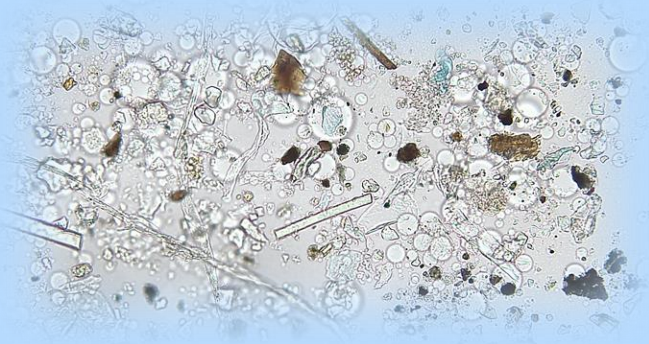
Given below are some examples and photo-micrographs of the most common and atypical “assemblage” conditions caused by “building generated” particles.

INDOOR PARTICLE “ASSEMBLAGES”



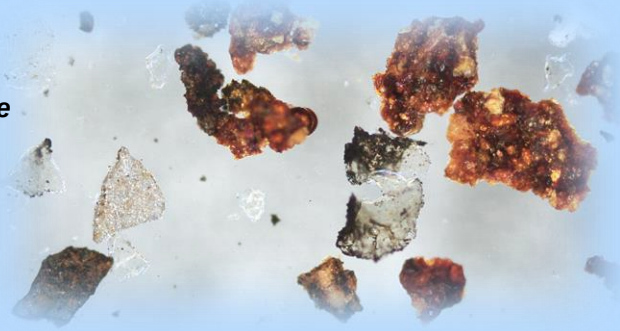
Biogenic particle shedding profile

- *Decayed bio-film particles*
- *Decayed vegetation*
- *Decayed skin cells*
- *Mold growth*



Construction renovation dust profile

- *Gypsum drywall dust*
- *Carbonate patching compounds*
- *Paint*
- *Fiberglass insulation*



HVAC / metal component corrosion dust profile

- *Al, Fe, Zn, Cu oxide metal flakes*
- *Salts- cations / anions, chlorides, etc.*
- *Rubber belt / gasket / insulation particles*

Fire / combustion residue profiles

Wildfire

- *Soot / char / ash*
- *Burned soil particles*
- *Burned pollen grains*
- *Firestorm vegetation and soil particles*

Structure fires

- *Melted plastics, metals, fabrics, hydrophobic soot*

AIR PROFILE™ THE EAA PARTICLE CLASSIFICATION SYSTEM

The EAA Particle Classification System uses particle morphology, optical properties, and assemblage association to classify common particles. In some cases the classification may not accurately represent the exact identity of an individual particle. Unusual particles can be placed in the "Other" category when found in elevated concentrations. Particle classifications can also be separated as being generated by biological (biogenic), or inorganic processes. Fibrous particles can be generated by biological, inorganic, or man-made processes. An analysis decision flow diagram is given on page 8.

BIOGENIC

Mold	Spores and filamentous structures generated from fungal growth
Algae and protozoan organisms	Chlorophyll producing "algae" spores or filaments and other protozoans associated with biofilm generation
Pollen & fern spores	Reproductive spores generated by flowering plants and ferns.
Skin cell fragments (Dander)	Skin cell fragments generated by human or animals
Insect parts	All particles associated with insects including leg parts, wing scales, and body chiton fragments

FIBROUS

Fibrous glass fibers (Isotropic)	Fibrous transparent glass fibers (fiberglass & mineral wool is used primarily as insulation materials and fillers in ceiling tiles)
Cellulosic fibers (Anisotropic)	Natural cellulosic fibrous materials used as clothing, paper, etc.
Synthetic fibers	Fibrous manufactured fibers used as clothing, bedding, drapes, carpeting, etc. (primarily nylon, rayon, etc.)

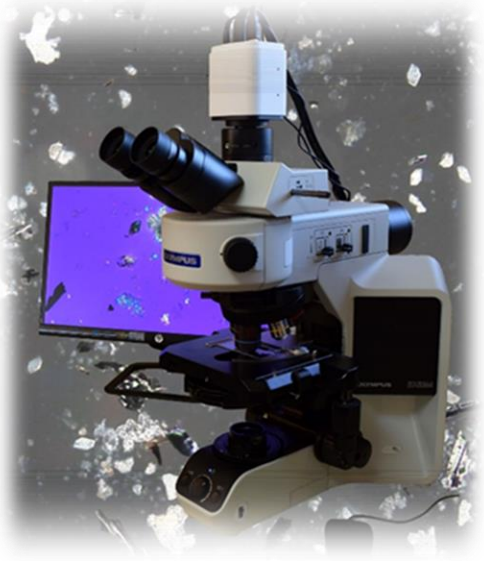
INORGANIC / ANTHROPOGENIC

Opaque particles	Particles that are optically opaque and appear as dark brown or black when using transmitted light microscopy. Particles are typically decayed biological material, corrosion particles, and paints / pigments.
Fire/combustion residue	Combustion particles including Soot, Char, Ash, and other burned plant or soil material including mineral grains, plant phytoliths, or pollen. Indoor fire residue will also include other plastics, furniture finishes, and construction materials
Anthropogenic/mineral particles	Crystalline soil mineral grains and/or construction materials
Other uncommon particles	Less common particles that may not directly fit the categories described above. These could include copier toner, starch grains, droplet-like particles, specific unique minerals, or corrosion particles.

AIRBORNE DUST ANALYSIS FLOW DIAGRAM

The EAA ***AIR PROFILE***™ guidelines provide a systematic way of identifying the source of indoor dust complaints using Optical Microscopy and automated SEM / X-ray particle analysis procedures.

Decision Diagram – Based on the statistical percentile frequency of occurrence found in buildings nationwide



Mold / Pollen / Algae

Typical-low <50%	Typical <75%	Atypical 75% - 95%	Elevated >95%
Background		Possible action	Action

Cellulosic/Synthetic fibers

Typical-low <50%	Typical <75%	Atypical 75% - 95%	Elevated >95%
Background		Possible action	Action

Opaque dust

Typical-low <50%	Typical <75%	Atypical 75% - 95%	Elevated >95%
Background		Possible action	Action

Source ID / chemistry / size distribution

Crystalline Mineral Dust

Typical-low <50%	Typical <75%	Atypical 75% - 95%	Elevated >95%
Background / Normal		Possible action	Action

Source ID / chemistry / size distribution

Fire / Combustion residue

Typical-low <50%	Typical <75%	Atypical 75% - 95%	Elevated >95%
Background / Normal		Possible action	Action

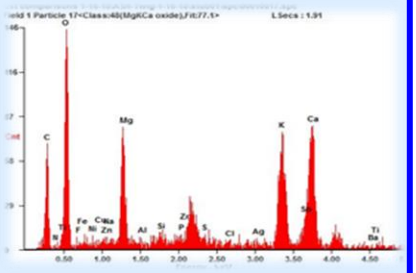
Source ID / chemistry / size distribution

Automated Scanning Electron Microscopy (SEM)

Particle chemistry

Size distribution

Particle ID → **Source identification**



MOLD & FUNGI - ECOLOGY

Elevated mold spore concentrations found in both the indoor and outdoor environment are known to cause allergy symptoms, and are occasionally responsible for respiratory illness in immuno-compromised individuals. Elevated mold spore concentrations in the indoor environment can be caused by outdoor infiltration or from indoor growth sources when elevated surface moisture and humidity are present.

Conditions under which indoor mold growth can occur

- 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 around windows
- Moisture condensation inside HVAC systems
- Persistent elevated relative humidity above 70%, and inadequate housekeeping

Ecology of molds and fungi

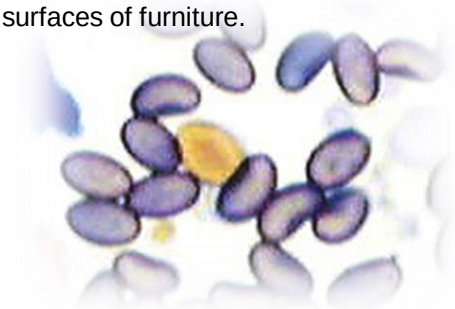
Mold and fungi require three basic criteria to colonize the inside of a building:

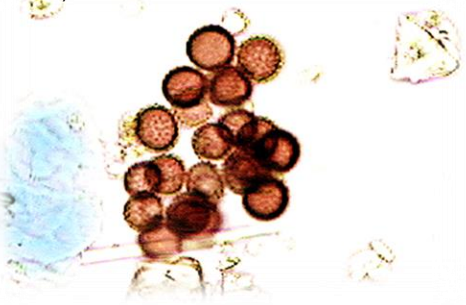
- A source of moisture
- A food source
- Lack of surface disturbance and/or air movement

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 inside HVAC systems. For example, in some parts of the country such as the southeast United States, the relative humidity during certain times of the year is high enough to act as a significant moisture source on its own.

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

Molds colonize most readily where air disturbance is minimal and both the surface and airborne humidity can remain high. For this reason, mold colonization occurs most frequently in closed or concealed spaces such as closets, storerooms, basements, refrigeration units, or on the backside or underside surfaces of furniture.





EAA Michigan laboratory

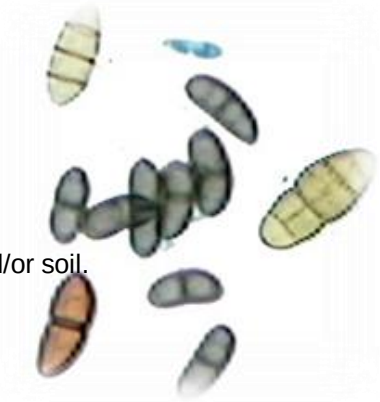
MOLD & FUNGI – HEALTH EFFECTS

Potential health effects from inhalation of mold and fungal spores:

Based on the existing literature, 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. Other individuals may have no symptoms at all. It is generally accepted that there are no long term or permanent health effects from exposure to mold once the occupant is removed from the property, or the "elevated" condition has been corrected. The medical community also generally recognizes that those who are known to be allergic to molds and those with asthma may have a higher risk of allergic reactions and should take extra precautions when in such situations. Laboratory analysis of airborne or surface samples by themselves cannot determine the associated health risks in any specific environment.

Common outdoor molds

Outdoor assemblages of mold spores are most commonly associated with the following genera (listed in approximate order of descending abundance):



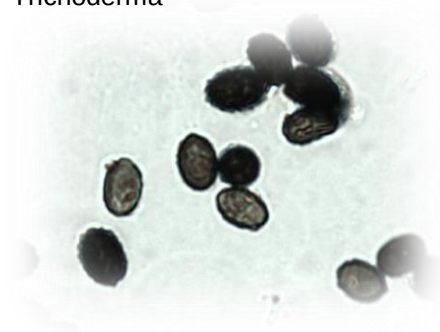
- Mushroom-like fungi (Ascospores and Basidiospores)
- Cladosporium
- Alternaria
- Rusts and Smuts (colonizing primary flower and leaf parts)
- Aspergillus & Penicillium (soil and moist cellulosic surfaces).

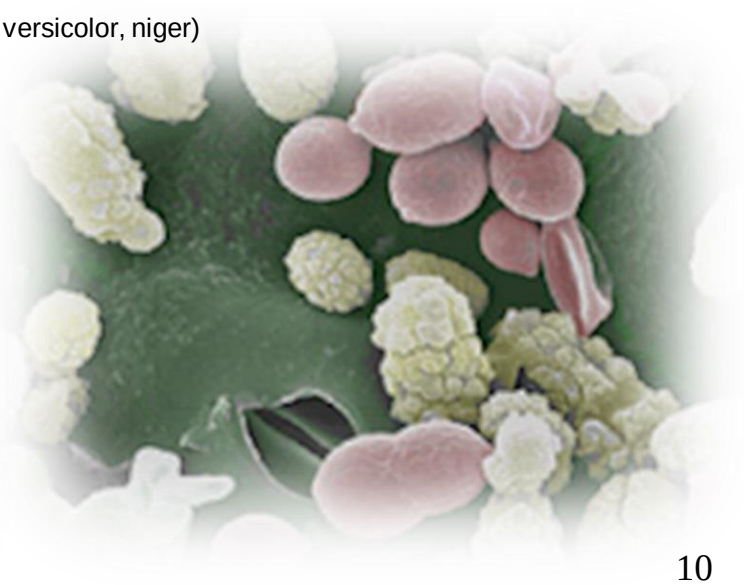
All of the above mentioned mold genera colonize decaying vegetation and/or soil.

Common molds associated with indoor mold "growth"

The most common molds associated with indoor amplification (over 90% of the typical mold growth found inside buildings) given in approximate order of descending abundance are listed below:

- Penicillium sp.
- Aspergillus (flavus, fumigatus, terrus, versicolor, niger)
- Cladosporium
- Chaetomium
- Stachybotrys
- Zygomycetes (Mucor & Rhizopus)
- Ulocladium
- Trichoderma





MOLD & FUNGI – GENERAL AIRBORNE BACKGROUND LEVELS

When chronic moisture intrusion exists, or significant flooding occurs, elevated levels of primary colonizing molds can be present (e.g. Penicillium, Aspergillus, and Cladosporium). Secondary mold growth (e.g. Stachybotrys, Chaetomium, Ulocladium, and Trichoderma) can occur with the presence of chronic moisture. This can also facilitate the colonization of wood-destroying fungi (i.e. Serpula, Poria). Over time, these kinds of fungi can destroy structural wood components of a building and result in very high indoor airborne basidiospore concentrations.

Overview on the interpretation of mold spore concentrations

A high variability in outdoor mold spore concentrations exists on an hourly basis. Levels are dependent on the quantity of local vegetation, the micro-climate, 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 mold concentrations, or over generalizing any set of indoor/outdoor data to desert or snow covered environments. It is also generally accepted that "single-point" comparisons between indoor and outdoor concentrations should not be relied upon as the primary criteria for determining acceptable levels in buildings.

The table given below summarizes the regional geographic outdoor background ranges and the most common conditions associated with elevated indoor mold spore levels. The term "clean" refers to the classification definition of buildings given in our AIHA 2005 Publication entitled "*A Regional Comparison of Mold Spore Concentrations Outdoors and Inside "Clean" and "Mold Contaminated" Southern California Buildings*, 2005, JOEH". The term "clean" used by EAA refers to a building found to have no evidence of historical water intrusion and no visible evidence of elevated moisture conditions or mold growth determined by a systematic and thorough visual inspection. This paper is also available on the "News and Information" page of the EAA website.

Typical Outdoor Mold Spore Concentration Ranges and Genera

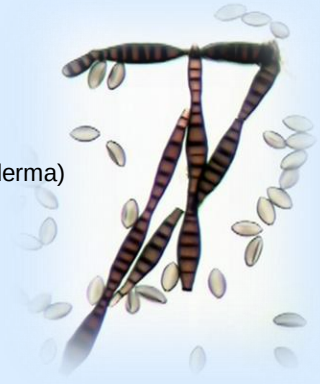
			Mold Genera and Prevalence				
Description / Condition	Spores (cts/m^3)		As/ba	Cla	Oth	As/Pe	W.I.
Arid / desert regions	50 -	5,000	C	C	C	L	T
Urban & coastal strip	200 -	30,000	C	C	C	L	T
Inland valley / native vegetation	500 -	50,000	P	P	C	L	T
Farms & heavy forestation	5,000 -	100,000	P	P	C	L	L
Typical Indoor Mold Spore Concentration Ranges							
"Clean" non-HVAC supplied air	ND -	1,600	C	C	C	L	T
"Clean" HVAC supplied air	ND -	500	L	L	L	L	T
Low - elevated, infiltration, pos. growth	600 -	13,000	L	C	L	C	L
Atypical – Growth likely	13,000 -	50,000	L	C	L	P	L
Elevated - Growth	>50,000		C	C	L	P	C
Inadequate flood cleanup/demolition	>50,000		C	C	C	P	C

Genera present

As/Ba – Asco / basidiospores
Cla – Cladosporium
Oth – Other (Alternaria, Dreschlera, Rusts, Smuts, etc.)
As/Pe – Aspergillus and/or Penicillium species
W.I. – Water Indicating - including (Stachybotrys, Chaetomium, Ulocladium, Trichoderma)

Genera Distribution / Concentration

ND – Not detected
P - Predominant (can comprise ~80% of the spore distribution)
C – Commonly occurring (can comprise ~50% of the spore distribution)
L - Low (comprises <10% of the spore distribution)
T – Trace (comprises <5% of the spore distribution)



USING THE EAA *AIR PROFILE*™ GUIDELINES

EAA has refined concise and understandable laboratory reports for the classification of airborne mold, and indicator dust categories. ***AIR PROFILE***™ is a trade-marked data interpretation systems used by EAA. The particle category and measured concentrations are systematically classified in a format that helps investigators determine if the *dust profile* is likely generated by occupant activity, moisture intrusion, building renovation activities, HVAC system corrosion, furnishings, and/or the infiltration of outdoor dust. Interpretation guidelines and color-coded data summary comparison tables are provided (in addition to the laboratory reports) that can easily be added into your own site inspection reports.

This version of our guidelines provides an updated color-coded airborne exposure summary page that is based on the statistical analysis of air samples analyzed by our own laboratory during the years of 2017-2018. This database consists of over 3,500 indoor and 1,500 outdoor samples collected nationwide. The enhanced guidelines integrate color-coded classifications representing specific statistical concentration ranges. The percentile frequency of occurrence is used to compare your airborne data measurements with the range of concentrations measured inside other buildings. The statistical ranges used by EAA are described below:

Elevated-6 — **>99th - percentile frequency of detection (Highest 1% of all measurements)**
Buildings with indoor generating sources and/or significant infiltration

Elevated-5 — **95th - 99th percentile frequency of detection (Highest 5% of all measurements)**
Buildings with indoor generating sources and/or atypical infiltration

Atypical-4 — **90th - 95th percentile frequency of detection (Highest 10% of all measurements)**
Possible generating sources, infrequent cleaning, and/or inadequate filtration

Atypical-3 — **75th - 90th percentile frequency of detection (Highest 25% of all measurements)**
Possible infrequent cleaning, low filtration, and/or high occupancy

Typical-2 — **50th - 75th percentile frequency of detection (50% of samples above the median)**
Average building

Typical-1 — **<50th - percentile frequency of detection (50% of samples below the median)**
Average "clean" non-impacted building

AIR PROFILE™ **INDOOR AIRBORNE MOLD SPORE CLASSIFICATION GUIDELINES**
2017-2018 Nationwide Database - Residential and Commercial Buildings (Mold spores/m³)

Classification/Level		Percentile Ranking	Total Spores	Aspergillus/ Penicillium	Water Indicating	* Outdoor Spores	Hyphae Fragments	Algal / Fern spores	Insect Parts
Elevated	6	>99%	>40000	>21000	>230	>16000	>340	>950	>1000
Elevated	5	>95%	>12000	>3500	>90	>8000	>170	>500	>500
Atypical	4	>90%	>6200	>1000	>50	>5000	>60	>240	>200
Atypical	3	>75%	>1600	>140	>20	>1500	>30	>140	>100
Typical	2	>50%	>400	>40	>10	>360	>15	>100	>60
Typical	1	<50%	<400	<40	<10	<360	<15	<100	<60

AIR PROFILE™ **INDOOR AIRBORNE DUST CLASSIFICATION GUIDELINES**
2017-2018 Nationwide Database - Residential and Commercial Buildings (Cts/m³)

Classification/Level		Percentile Ranking	Pollen	Skin Cell Fragments	Fiberglass	Cellulose / Synthetic Fibers	Unidentified Opaque	Soil / Crystalline Minerals	Fire residue / Other Particles
Elevated	6	>99%	> 40	> 30000	> 650	> 5900	> 41000	> 132000	> 54000
Elevated	5	>95%	> 35	> 15000	> 90	> 1800	> 13000	> 41000	> 9000
Atypical	4	>90%	> 16	> 10000	> 30	> 1100	> 8000	> 22000	> 4000
Atypical	3	>75%	> 8	> 6000	> 15	> 600	> 4000	> 9000	> 1400
Typical	2	>50%	> 4	> 3000	> 7	> 300	> 1800	> 4000	> 500
Typical	1	<50%	< 4	< 3000	< 7	< 300	< 1800	< 4000	< 500

USING THE EAA *DUST PROFILE*™ GUIDELINES

EAA provides concise and understandable laboratory reports for the classification of surface mold, and indicator dust categories. ***DUST PROFILE***™ is a trade-marked data interpretation system used by EAA. The particle category and measured concentrations are systematically classified in a format that helps investigators determine if the *dust profile* is likely generated by occupant activity, moisture intrusion, building renovation activities, HVAC system corrosion, furnishings, and/or the infiltration of outdoor dust. Interpretation guidelines and color-coded data summary comparison tables are provided (in addition to the laboratory reports) that can easily be added into your own site inspection reports.

These guidelines provide a color-coded surface dust summary page that is based on the statistical percentile analysis of surface samples analyzed throughout the United States by our own laboratory during the years of 2015-2019. This database consists of over 500 tape lift surface samples collected from "Typical" buildings and 150 "Problem" buildings. The percentile frequency of occurrence is used to compare your airborne data measurements with the range of concentrations measured inside other buildings. The statistical ranges used by EAA are described below:

Elevated-6 — **99th - percentile frequency of detection (Highest 1% of all measurements)**
Buildings with indoor generating sources and/or significant infiltration

Elevated-5 — **95th - percentile frequency of detection (Highest 5% of all measurements)**
Buildings with indoor generating sources and/or atypical infiltration

Atypical-4 — **90th - 95th percentile frequency of detection (Highest 10% of all measurements)**
Possible generating sources, infrequent cleaning, and/or inadequate filtration

Atypical-3 — **75th - 90th percentile frequency of detection (Highest 25% of all measurements)**
Possible infrequent cleaning, low filtration, and/or high occupancy

Typical-2 — **50th - 75th percentile frequency of detection (50% of samples above the median)**
Average / typical building

Typical-1 — **<50th - percentile frequency of detection (50% of samples below the median)**
Average "clean" non-impacted building

CLASSIFICATION GUIDELINES - Average Residential and Commercial Buildings (Particles / mm²)
Database of over 500 surfaces samples collected in "Typical" Buildings

Classification	*Percentile Ranking	Total Mold Spores	Aspergillus/ Penicillium	Chronic Water Indicating	Typical Outdoor Molds	Hyphae Fragments	~ 150 "Problem" Building Samples: Total Mold Spores	Aspergillus/ Penicillium	Hyphae Fragments
Elevated - 6	>99%	>40	>6.0	>1.0	>30	>3.0	>20000	>17000	>2000
Elevated - 5	>95%	>10	>1.0	>0.2	>7.0	>1.0	>4100	>2000	>700
Atypical - 4	>90%	>5.0	>0.10	>0.10	>4.0	>0.70	>2000	>260	>120
Atypical -3	>75%	>2.0	>0.05	>0.01	>1.0	>0.05	>45	>0.1	>3.0
Typical - 2	>50%	>0.2	>0.01	>0.001	>0.10	>0.02	>4.0	>0.01	>0.02
Typical - 1	<50%	< 0.2	<0.01	< 0.001	<0.10	<0.02	<4.0	<0.01	<0.02
Frequency of detection		63%	9%	1%	63%	20%	83%	25%	38%

CLASSIFICATION GUIDELINES - Average Residential and Commercial Buildings (Particles / mm²)
Database of over 500 surfaces samples collected in "Typical" Buildings

Classification	Approximate Percentile Ranking	Pollen	Skin Cell Fragments	Fiberglass	Cellulose / Synthetic Fibers	Unidentified Opaque	Soil / Crystalline Minerals	*Suspect problem Buildings Only* Fire Residue	* Other
Elevated - 6	>99%	>10	>260	>3.0	>75	>700	>900	>3360	
Elevated - 5	>95%	>2.0	>150	>1.0	>50	>130	>240	>1680	> 50
Atypical - 4	>90%	>1.0	>110	>0.7	>25	>60	>140	>388	>25
Atypical -3	>75%	>0.3	>35	>0.1	>10	>20	>60	>4.0	>10
Typical - 2	>50%	>0.0	>12	>0.03	>3.0	>7.0	>15	>0.04	>3.0
Typical - 1	<50%	<0.04	<12.0	<0.03	<3.0	<7.0	<15	<0.04	<3.0
Frequency of detection		33%	96%	26%	93%	98%	99%	Not measured	

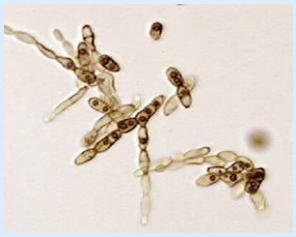
MOLD & FUNGI – INDOOR GUIDELINES

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Outside	Variable by season	0.1 – 200		ND – 200,000
Elevated - amplification possible	Elevated - 6	> 40	>99th	* >40,000
Elevated mold present	Elevated - 5	* > 10	>95th	* >12,000
Atypical - possible source	Atypical – 4	* > 5	>90th	* > 6,200
Atypical – marginally elevated	Atypical - 3	* > 2	>75th	* > 1,600
Inside air "typical" residential	Typical - 2	> 0.2	>50th	* > 400
Inside air "clean" HVAC buildings	Typical - 1	< 0.2	<50th	* < 400

** Depends upon the genera / species present*

The upper range of <u>total</u> mold spore concentrations in a typical building (i.e. 75th percentile) is approximately 1,600 cts/m^3 with an average (50th percentile) of 400 cts/m^3. Aspergillus /Penicillium spores (see previous page) have an upper range (75th percentile) of 140 cts/m^3 with an average (50th percentile) of ~40 ct/m^3. Aspergillus/Penicillium spore concentrations above the 90th percentile of 1,000 cts/m^3 should be considered to be elevated. Stachybotrys, Chaetomium, and Ulocladium (potential indicators of chronic surface moisture) are often recovered in low concentrations in indoor samples as a result of normal infiltration. Therefore, detection in low concentrations does not necessarily indicate an indoor growth source. Because there is no direct relationship between simultaneously collected indoor and outdoor samples, performing a direct comparison without outdoor data should only be used as a "positive" control to determine if the outdoor environment is contaminating the indoor environment. Outdoor levels are not a reliable "baseline" control for "acceptable" indoor spore levels.

Mold spores commonly found outdoors and indoors

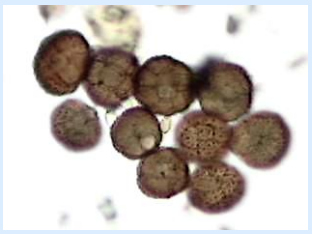

Cladosporium


Ascospores

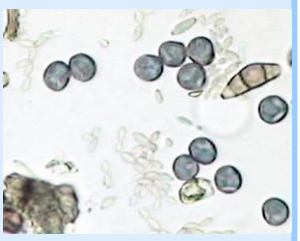

"Poria" dry rot spores


Alternaria

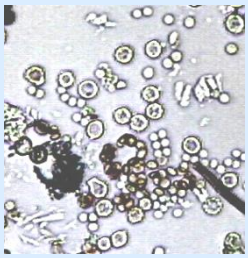

Bipolaris-like


Epiccocum

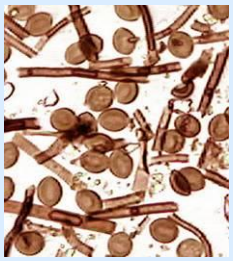

Curvularia


Smut-like

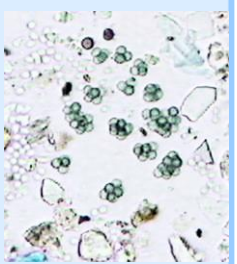
Mold spores most commonly associated with indoor growth (amplification)


Penicillium/Aspergillus


Stachybotrys


Chaetomium


Pithomyces / Ulocladium


Trichoderma

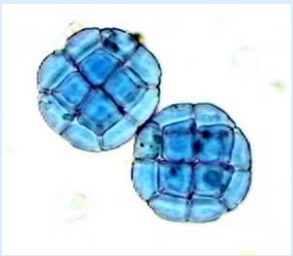
POLLEN / FERN SPORES

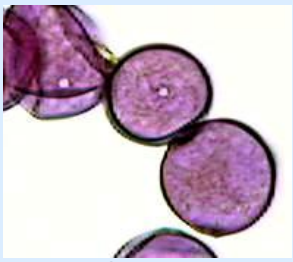
Description Outside	Classification-Level Variable by season	Surface (cts/mm^2) 0.1 – 100	Percentile	Airborne (cts/m^3) 0.5 – 3,000
Elevated - infiltration present	Elevated - 6	> 10	> 99th	> 40
Elevated - Infiltration possible	Elevated - 5	> 2.0	>95th	> 35
Atypical – low infiltration	Atypical - 4	> 1.0	>90th	> 16
Atypical - present	Atypical - 3	> 0.3	>75th	> 8
Inside (Low-typical)	Typical - 2	> 0.1	>50th	> 4
Inside Low	Typical - 1	< 0.1	<50th	< 4

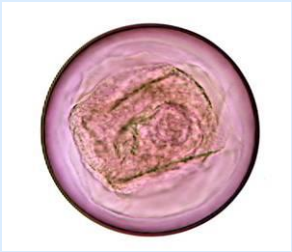
The presence of pollen or fern spores in the indoor environment is almost always the result of outdoor air infiltration. In a typical HVAC air supplied building, airborne pollen concentrations will be very low (less than ~16 ct/m^3) or not detected at all. Sensitive individuals can mistakenly attribute complaints to the interior of a building that are actually the result of exterior infiltration or other allergen sources. Landscaping in building courtyards can also be a factor with perceived indoor problems. The time of year, the home environment, and pathway to work, may also be significant sources for potential exposure.

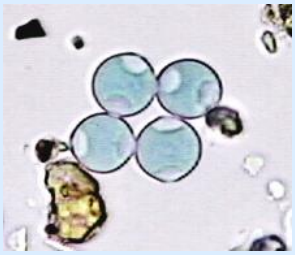
According to the medical literature, the individual allergy response to pollen exposure is highly variable. Some individuals with pollen allergies may begin to exhibit symptoms when airborne concentrations exceed approximately 50 cts/m^3, especially with grass or highly allergenic pollen such as ragweed. Outdoor airborne levels can range from not detected to over 3,000 cts/m^3 depending on the geographic location, local vegetation, and season. The time of day when symptoms are pronounced is extremely critical for proper source diagnosis. Because of the wide range and severity of individual pollen allergies, consultation with an Allergist may be warranted in the rare occasions where elevated indoor pollen concentrations have been measured.

Pollen identification in the EAA analysis report is given as the genus when known, or as the taxonomic classification (e.g. inaperturate, triporate, tricolpate, etc.) when the pollen cannot be readily identified. Detailed speciation of pollen is only provided upon special request.

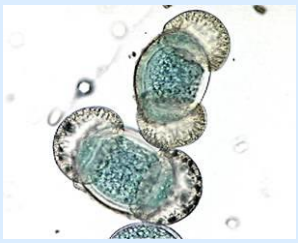

Acacia

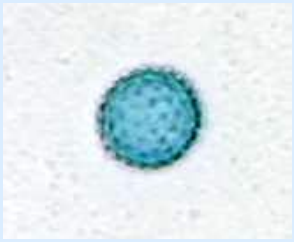

Grass

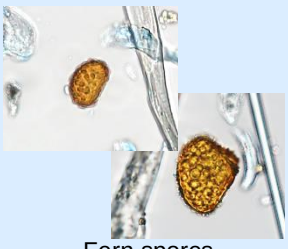

Fir


Betula (Birch)


Tricolporate (classification)


Pinus-like


Ragweed


Fern spores

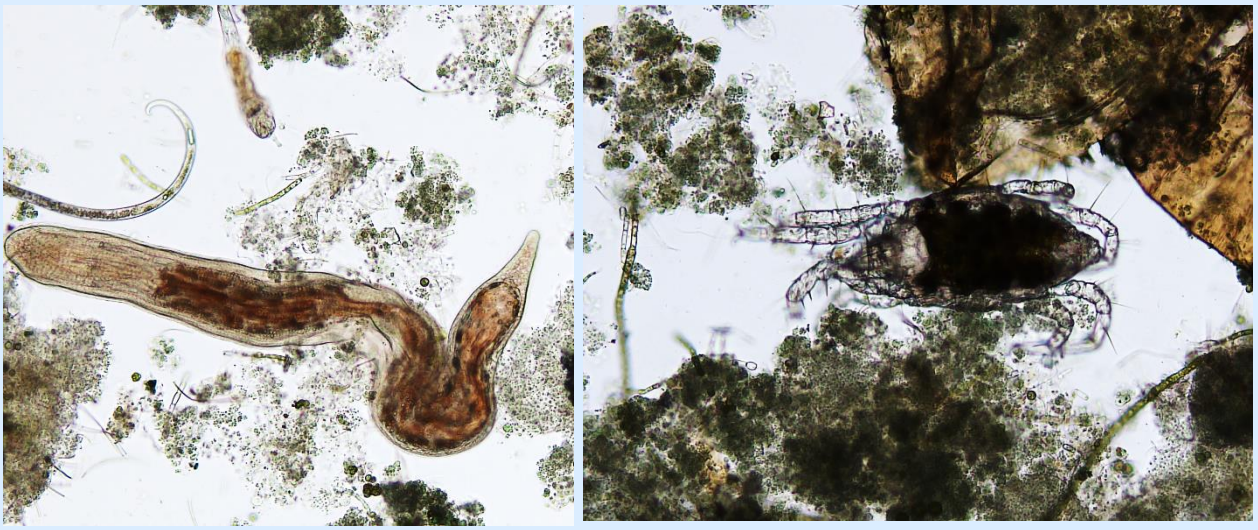
ALGAE, MITES, & OTHER ORGANISMS

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated-source likely	Elevated - 6	NA	>99th	> 950
Elevated-source possible	Elevated - 5	> 0.5	>95th	> 500
Atypical – source possible	Atypical - 4	> 0.3	>90th	> 240
Atypical – source possible	Atypical - 3	> 0.1	>75th	> 140
Typical background	Typical - 2	< 0.1	>50th	> 100
Typical low background	Typical - 1	Not measured	<50th	< 100

Note: Values are estimates due to the low frequency of occurrence

When algae, bio-film deposits, protozoan organisms, etc. are detected in any concentration in indoor samples, a stagnant or chronic water source is likely present. Although significant information is not readily available regarding health effects, algae and bio-film organisms are potential indicators of persistent moisture and other potential bacteriological or protozoa reservoirs.

Algae spores and filaments – 750x



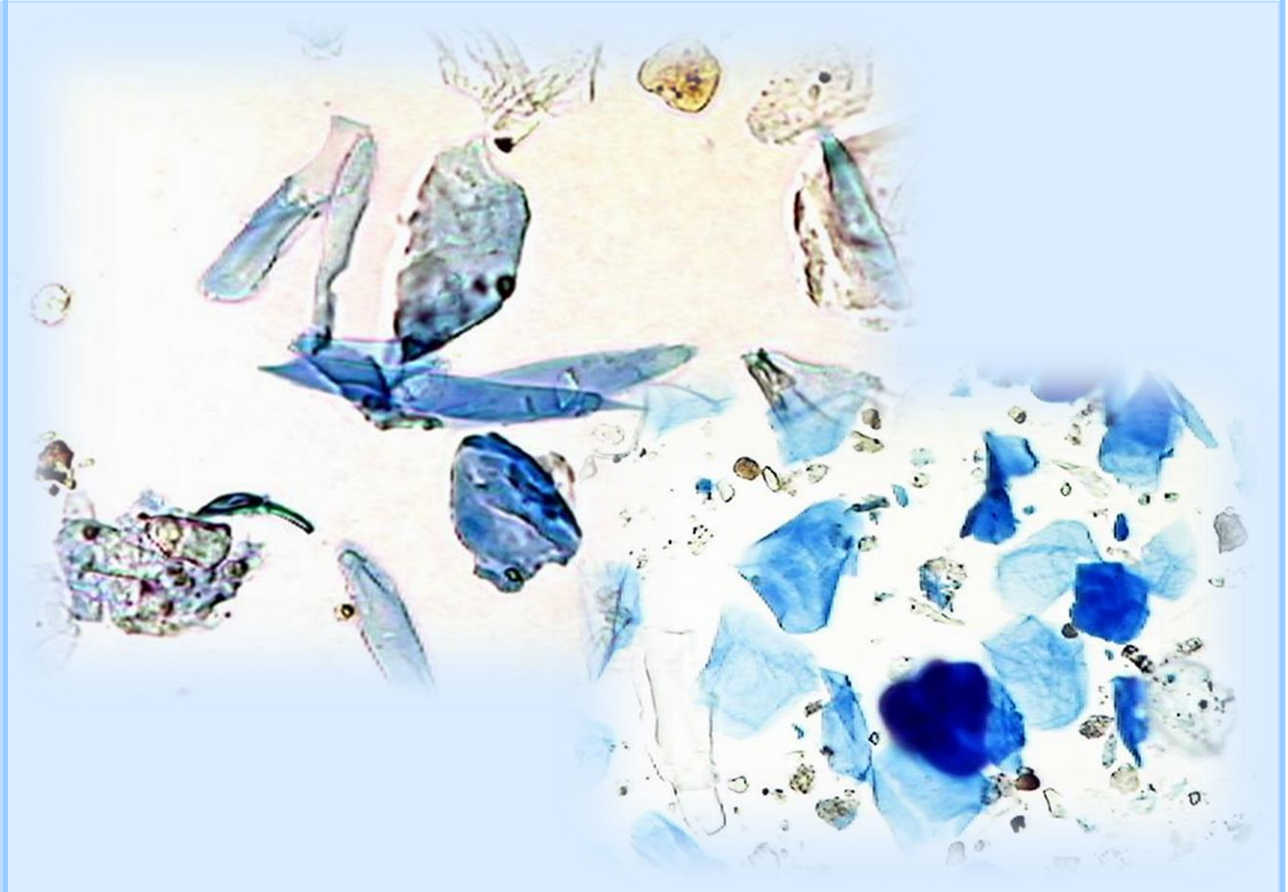
Bio-film organisms and decayed debris associated organisms – 100x

SKIN CELL FRAGMENTS – (DANDER)

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Outside	Low range	<0.1		7 - 1,000
Elevated - high activity	Elevated - 6	>260	>99th	>30,000
Elevated – moderate activity	Elevated - 5	>150	>95th	>15,000
Atypical - moderate activity	Atypical - 4	>110	>90th	>10,000
Atypical - marginally elevated	Atypical - 3	> 35	>75th	> 6,000
Typical background	Typical - 2	> 12	>50th	> 3,000
Typical low background	Typical - 1	< 12	<50th	< 3,000

Dander or skin cell fragments are the most common source of particle debris in indoor samples. The skin cell fragment category includes particle concentrations greater than ~20µm in diameter. One of the biggest differences between inside and outside air quality is the high concentration of skin cell fragments and human-borne contaminants (i.e. bacteria, viruses) found indoors 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 routinely 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 surrogate indicator of the total impact of occupant density, commensal bacteria potential, housekeeping cleaning practices, and the filtration of recirculated air in the building.

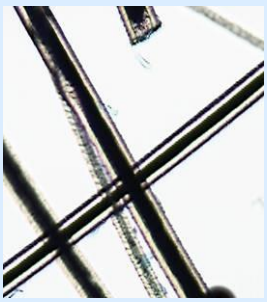


BIOLOGICAL, CELLULOSIC, & SYNTHETIC FIBERS

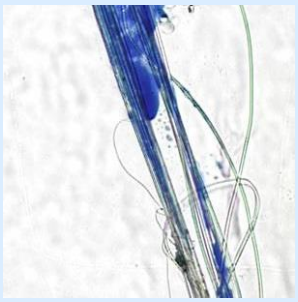
Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Outside--(Usually plant fragments)	Variable	0.1 - 5.0		100 - 1,000
Elevated - active source	Elevated - 6	> 75	>99th	>5,900
Elevated - source possible	Elevated - 5	> 50	>95th	>1,800
Atypical - moderate activity	Atypical - 4	> 25	>90th	>1,000
Atypical - moderate activity	Atypical - 3	> 10	>75th	> 600
Typical background	Atypical - 2	> 3	>50th	> 300
Typical - low background	Atypical - 1	< 3	<50th	< 300

The cellulosic / synthetic fiber category covers a wide range of carbonaceous fibers that are commonly found in indoor samples. Fibers in this category include biogenic fibers (derived from biological activity, e.g. leaf and twig fragments, trichomes, spider web silk, vegetation fibers, hair/fur, feather fibrils), clothing fibers (cotton and synthetic fabrics), and nylon carpet fibers. Indoor fiber emission sources can include architectural finishes, cellulose insulation, and other paper products. These fibers for the most part are anisotropic (crystalline), and will appear yellow and/or blue depending on their orientation when examined using a polarized light microscope with a full wave plate inserted. Some synthetic fibers will appear yellow in all orientation directions, that is, the same light vibration in all directions. Biogenic fibers generated from biological sources (plant, insect, or animal) by themselves are not normally a cause of allergy or illness symptoms. Elevated biogenic and fabric fibers may be an indication of inadequate housekeeping, ventilation, high biogenic sources, and/or high occupancy rates.

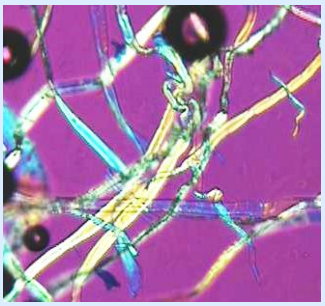
Down feather fibril



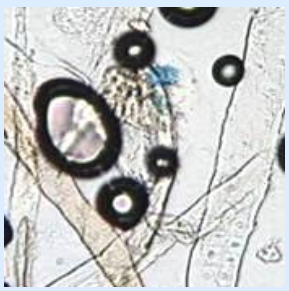
Dog hair



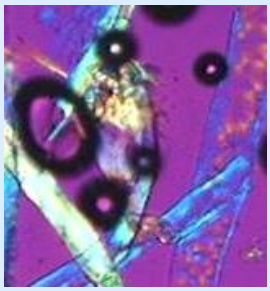
Spider web



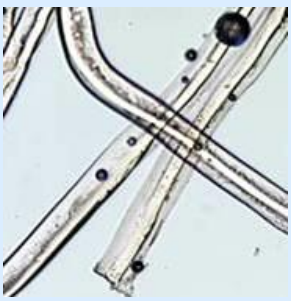
"Kleenex" tissue (PLM)



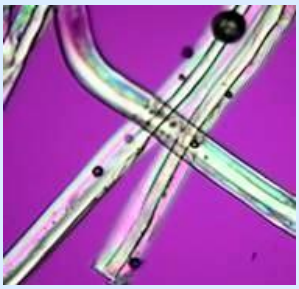
Cardboard (BF)



Cardboard (PLM)



Nylon carpet (BF)



Nylon carpet (PLM)

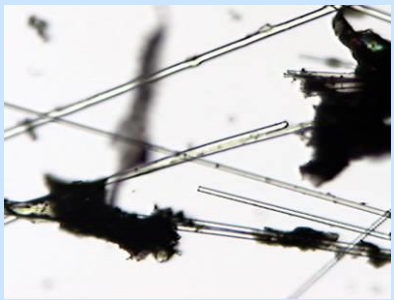
FIBERGLASS FIBERS

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated-source present	Elevated - 6	> 3	>99th	> 650
Elevated-source possible	Elevated - 5	> 1	>95th	> 90
High activity	Atypical – 4	> 0.7	>90th	> 30
Marginal potential source	Atypical - 3	> 0.1	>75th	> 15
Typical background	Typical - 2	> 0.03	>50th	> 8
Typical low background	Typical - 1	< 0.03	<50th	< 8

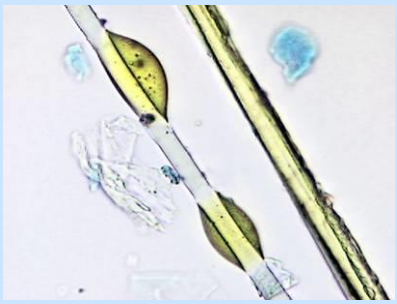
Fiberglass fibers are composed of amorphous (non-crystalline) fibrous glass particles and are most commonly found in insulation products. Fibrous glass sources may include thermal or sound insulation, ceiling tiles, debris from renovation projects, or the degradation of HVAC system sound dampening insulation inside the ventilation ducting system.

Because “fiberglass” and mineral wool are manufactured by different processes, they are morphologically different but may be chemically similar. 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 fiber categories are isotropic (non-crystalline) 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 (full) wave plate in addition to polarized light. When a full wave retardation plate is inserted, these fibers will appear colorless in all orientations.

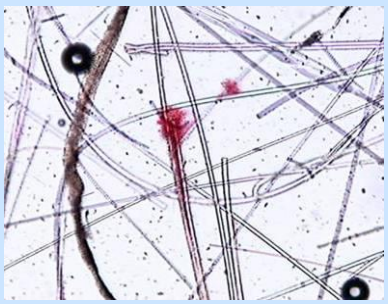
The macroscopic coloration of bulk insulation (e.g. yellow, pink, black) is due to the resin binder holding the insulation together and not the color of the glass fiber. All fibrous glass fibers are typically colorless. The source and location of fiberglass insulation in a building can sometimes be differentiated by the resin droplet color used as a binding material on the glass fiber itself.



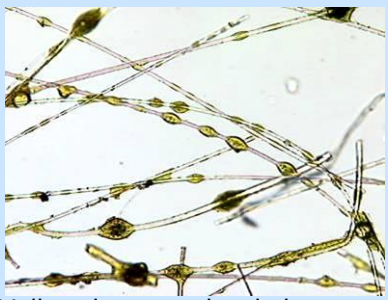
Black sound liner fiberglass



Yellow “batt” insulation

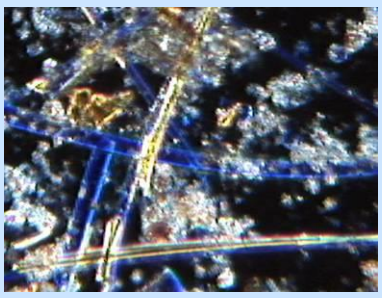


Pink “batt” insulation



Yellow duct wrap insulation

Mineral wool – ceiling tile



Fiberglass (PLM-dispersion staining)

OPAQUE PARTICLES OVERVIEW

Initial analysis is performed by Optical Microscopy. Automated SEM analysis may be required to identify the exact composition of the dust and to identify the most likely source.

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated - source present	Elevated - 6	> 700	>99th	>41,000
Elevated - source possible	Elevated - 5	> 130	>95th	>13,000
Atypical - Infiltration / source possible	Atypical – 4	> 60	>90th	> 8,000
Atypical - low-moderate dust	Atypical - 3	> 20	>75th	> 4,000
Typical background	Typical - 2	> 7	>50th	> 1,800
Typical – low background	Typical - 1	< 7	<50th	< 1,800

The opaque particle category encompasses a wide range of unrelated biological and anthropogenic (man-made) particles that appear to be brown or black when observed using Transmitted Light Microscopy. These optically opaque particles may visually be other colors to the naked eye or when examined using Reflected Light Microscopy. These particles often require the use of Reflected Light Dark Field microscopy, and/or SEM / X-ray analysis to identify the type, chemistry, or origin of the particle. Commonly occurring optically opaque particles are generated from five major processes including:

1. Infiltration of optically opaque occurring soil particles, biological debris, asphaltic debris, and tire rubber
2. Biological / biogenic decay – Decayed skin cells, bio-films, insect droppings, oil residues
3. Corrosion – Degradation of metal HVAC components, pipes, paint, pigments
4. Friction/abrasion – Materials released as result of HVAC component vibration and moving parts
5. Combustion – Burning and heating of biogenic, organic, and other combustible materials

Note: In order to differentiate "fire residue particles" from general opaque particles, additional sub-analysis must be requested.

Micrographs of these various types of opaque particles are given on the following pages.

The most common outdoor sources of "opaque" or black/brown particles are soil, decayed vegetation, automobile emissions, insect droppings, and generally very low concentrations of fire residue particles.

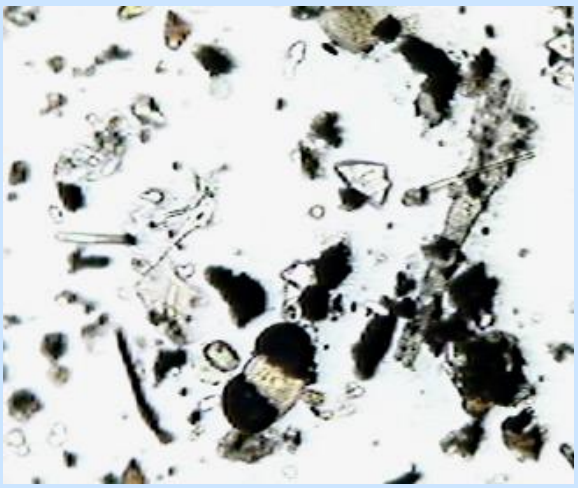
The most common indoor generated particles include paint, binders from degrading sound liners in HVAC systems, biogenic debris (biological origin, e.g. insect droppings, decayed biological debris, etc.), fan belt rubber particles, oil residue/dust agglomerates, copier toner, corrosion from HVAC components and metal ducting, and occasionally combustion emissions (soot & char). Determining the particle chemistry and the generating source usually requires additional analysis by automated Scanning Electron Microscopy (SEM) / X-ray analysis. The airborne concentration of total "opaque" particles does not normally occur in concentrations exceeding approximately 10,000 cts/m^3 in "clean" indoor environments. Identification of the particle origin is not always possible, however, should be investigated as a possible contributor to air quality complaints when airborne concentrations exceed ~16,000 cts/m^3.

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 / X-ray or chemical analysis.

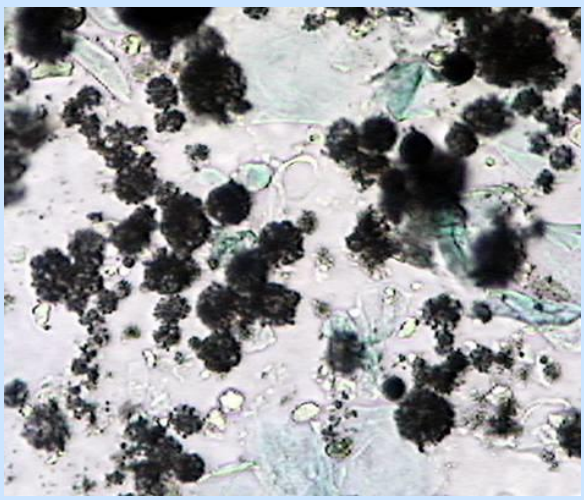
OPAQUE PARTICLES (Primarily biogenic)

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated - source present	Elevated - 6	> 700	>99th	>41,000
Elevated - source possible	Elevated - 5	> 130	>95th	>13,000
Atypical - building infiltration likely	Atypical - 4	> 60	>90th	> 8,000
Atypical - low-moderate dust	Atypical - 3	> 20	>75th	> 4,000
Typical background	Typical - 2	> 7	>50th	> 1,800
Typical - low background	Typical - 1	< 7	<50th	< 1,800

Biogenic opaque black or brown debris are derived from the chemical or micro-biological decomposition of organic debris. The most common indoor sources are decayed soil vegetation, mold, dander, 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 on the edges of, and/or throughout the particle. Examples of high levels of airborne biogenic derived debris (i.e. >100,000 cts/m^3) are given below:

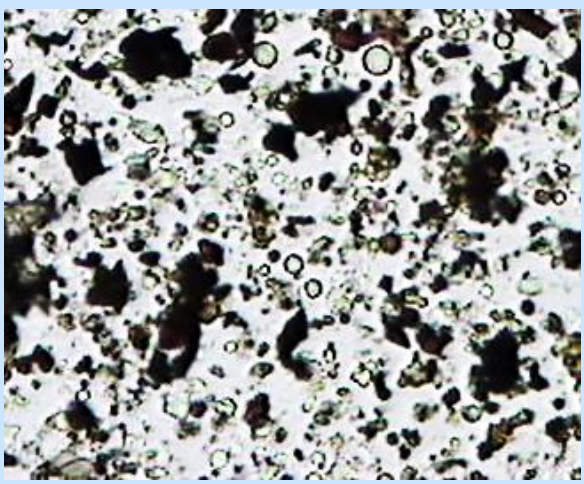


Outdoor plant/soil debris & insect droppings



HVAC duct residue

Decaying fungal debris



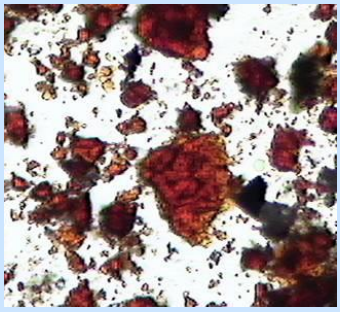
Floor sweepings from a garage

OPAQUE PARTICLES (Corrosion & friction)

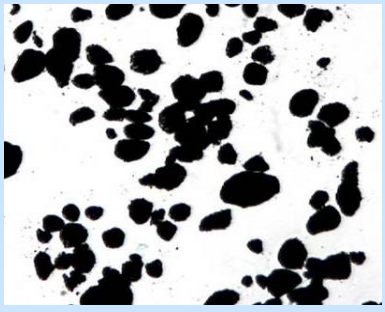
Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated - source present	Elevated - 6	> 700	>99th	>41,000
Elevated - source possible	Elevated - 5	> 130	>95th	>13,000
Moderate - building infiltration likely	Atypical - 4	> 60	>90th	> 8,000
Low-moderate dust	Atypical - 3	> 20	>75th	> 4,000
Typical background	Typical - 2	> 7	>50th	> 1,800
Typical – low background	Typical - 1	< 7	<50th	< 1,800

Man-made and opaque corrosion particles are derived from chemical or physical degradation, corrosion, and shedding of mineral, resinous, bituminous, or rubber debris (tire rubber, motor belts). The most common indoor sources are metal corrosion (Aluminum, Zinc, Iron) from HVAC system components, or pigment and paint shedding from building surfaces. These types of opaque particles can often be separated from other sources by using a combination of transmitted and reflected light microscopy. Exact identification and quantification may require SEM and X-ray elemental analysis.

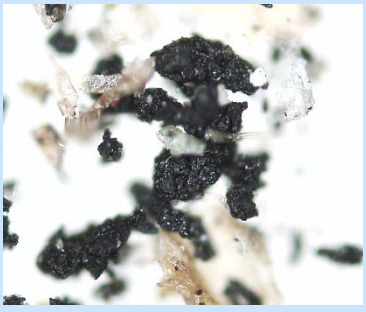
Most non-biogenic opaque particles have angular and distinct edges, and a low variation in optical density from the edge to the center of the particle in transmitted light illumination. They can often be identified or classified based on the characteristic surface pitting structure using Reflected Light/Dark Field Microscopy (see bottom picture of HVAC corrosion).



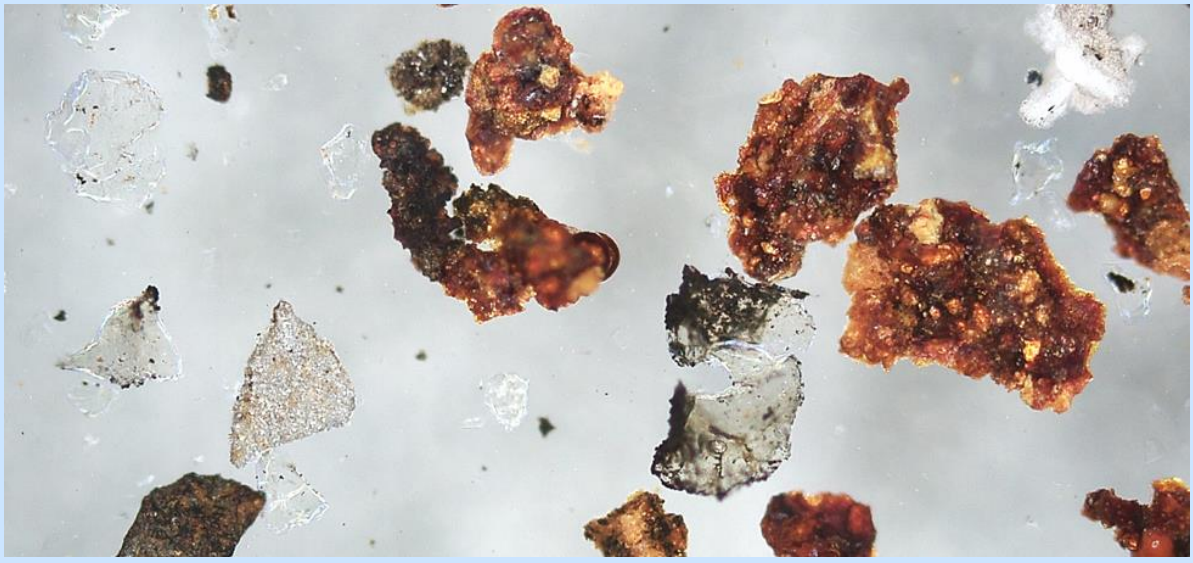
Iron rust particles



Copier toner



Tire rubber particles



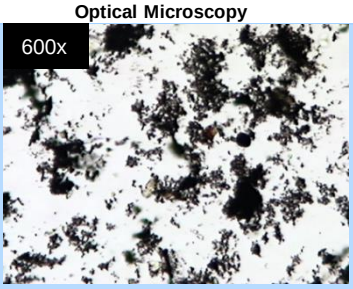
HVAC system corrosion particles (Aluminum, Iron, and Zinc oxide particles)

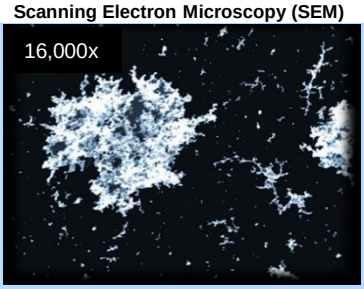
COMBUSTION RESIDUE (Wildfire & Structure Fires)

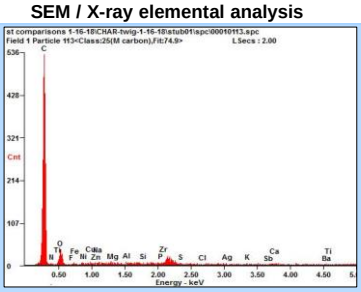
Description	Classification-Level	Surface Ratio %	Surface Cts/mm^2	Percentile	Airborne cts/m^3
Elevated- source present	Elevated - 6	NA	NA	>99th	> 54,000
Elevated-source possible	Elevated - 5	>10 %	> 50	>95th	> 9,000
Atypical-source possible	Atypical - 4	> 5 %	> 10	>90th	> 4,000
Atypical - marginal	Atypical - 3	> 3 %	> 5	>75th	> 1,500
Typical background	Typical - 2	> 1 %	> 1	>50th	> 600
Typical - low background	Typical - 1	< 1 %	< 1	<50th	< 500

Combustion particles can be separated into three basic categories (soot, char, and ash). There are also other indicator particles that can assist in the differentiation of wildfire and structure fire residues from other types of combustion sources. Wildfire combustion particles are a complex mixture of cellulose vegetation, burned soil, residual salts, and crystalline calcium and silica vegetation particles (phytoliths). Structure fires have a different particle distribution, typically with higher ratios of soot particles and other melted plastics, paint, and metals. Quantifying airborne and surface fire combustion contamination is a multi-step process requiring Optical Microscopy (Polarized Light & Reflected Light). Automated Scanning Electron Microscopy/X-ray analysis can be utilized to help differentiate look-alike interference particles from actual combustion residue or confirm the “ash” chemistry.

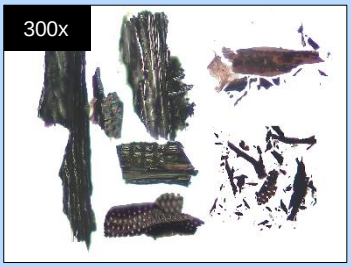
Optical Microscopy | **Scanning Electron Microscopy (SEM)** | **SEM / X-ray elemental analysis**

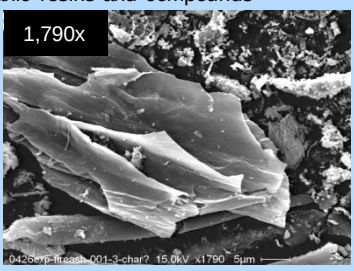


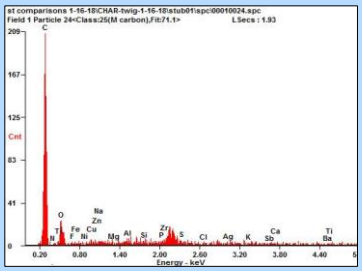




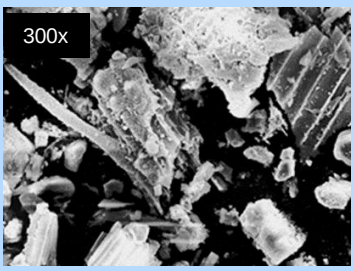
Soot – Residues from the combustion of organic resins and compounds

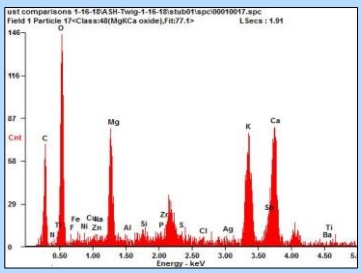




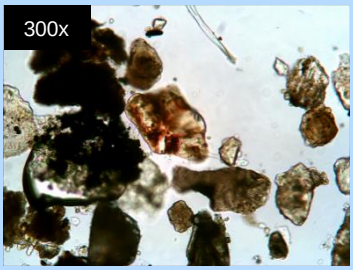


Char – Incomplete combustion of cellulose vegetation material



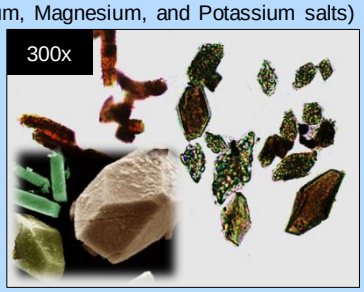


Ash – The residual mineral elements remaining after combustion (primarily Calcium, Sodium, Magnesium, and Potassium salts)



Wildfire Indicator
Burned/carbonized mineral grains

Wildfire Indicator
Burned pollen



Wildfire Indicator
Burned oak tree phytoliths

INSECT PARTS

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated–source possible	Elevated - 6	NA	>99th	> 1000
Elevated-atypical levels present	Elevated - 5	> 10.0	>95th	> 500
Atypical	Atypical - 4	> 5.0	>90th	> 200
Atypical - marginal	Atypical - 3	> 1.0	>75th	> 100
Typical background	Typical - 2	> 0.1	>50th	> 60
Typical - low background	Typical - 1	< 0.1	<50th	< 60

Note: Values are estimates due to the low frequency of occurrence

Recognizable insect parts can be comprised of whole insects or fragments (e.g. body parts, antennae, legs, scales, body hairs, and wing fragments). In clean indoor environments, insect parts are occasionally detected, however, airborne concentrations above ~100 cts/m^3 in air samples are not routinely measured. Elevated concentrations of wings scales, body parts, or insect droppings found in airborne or surface samples may be an indicator of an infestation or inadequate building maintenance and/or air filtration. Occasionally dust mites are also found when inadequate housekeeping, high moisture levels, or extensive mold growth is present.

Dust & carpet mites

Moth wing scale

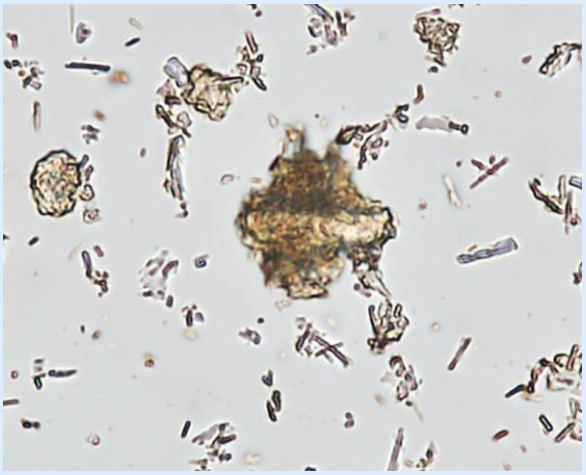
Insect body hair

Insect body hair

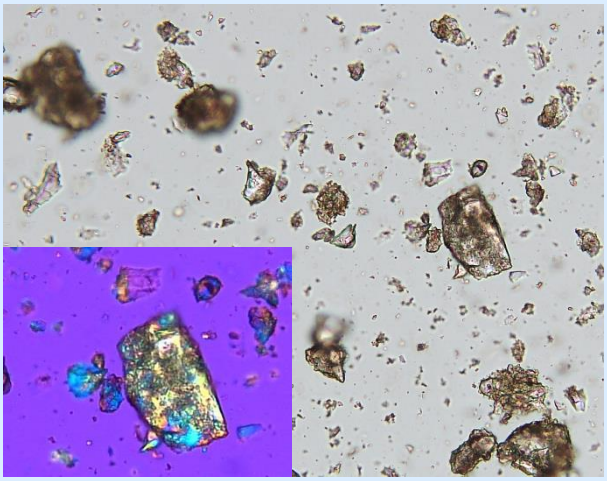
CRYSTALLINE MINERALS – Soil / construction dust

Description	Classification-Level	Surface Cts/mm^2	Percentile	Airborne Cts/m^3
Elevated source likely present	Elevated - 6	> 900	>99th	> 132,000
Elevated source possible	Elevated - 5	> 240	>95th	> 41,000
Atypical - moderate dust source	Atypical - 4	> 140	>90th	> 22,000
Atypical - low-moderate dust source	Atypical - 3	> 60	>75th	> 9,000
Typical background	Typical - 2	> 15	>50th	> 4,000
Typical – low background	Typical - 1	< 15	<50th	< 4,000

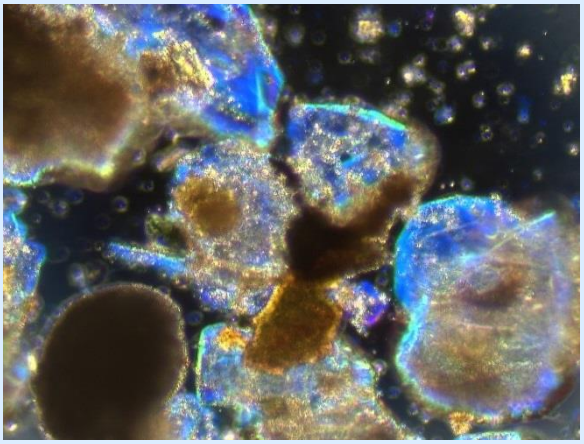
Crystalline mineral particles found indoors are generated by two primary sources, 1). Infiltrated and naturally occurring soil particles and, 2). Building construction and finish materials. Construction materials are composed mostly of carbonate, gypsum, and silicate particles generated from the application and renovation of building components, drywall, patching compounds, flooring adhesives, and paint. Infiltrated soil minerals are mostly composed of naturally occurring aluminum silicate clays, quartz, and Calcium carbonates and sulfates. Mineral dust particles are classified in the analysis as those particles that are transparent to translucent, and are birefringent in cross-polarized light.



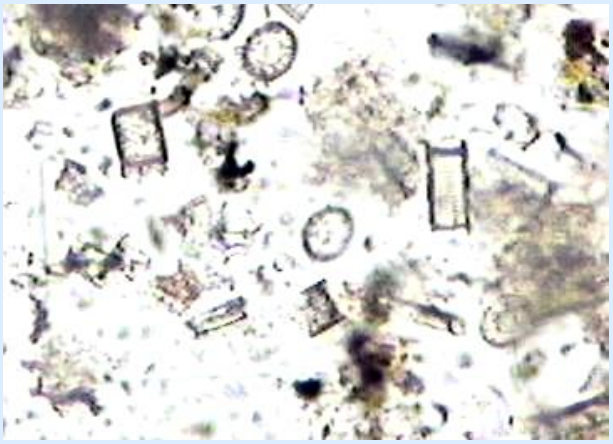
Drywall dust (gypsum) - 750x



Calcium carbonate - 750x



Quartz beach sand - dispersion staining - 100x



Diatomite - 750x

AIR PROFILE™ **INDOOR AIRBORNE MOLD INTERPRETATION GUIDELINES** *doc.rev.2020-19.1 4/10/20*

Based on the Environmental Analysis Associates, Inc. 2017/2018 Air Sample Database *Page 0 of 0*

IMPORTANT: Laboratory results are secondary information used to support a thorough visual inspection performed by a qualified environmental professional. The EAA concentration range definitions and color-coding (*Typical*, *Atypical*, or *Elevated*), are to be used for a comparison with historical data only. The individual sample results or descriptive ranges cannot be used as the sole criteria to determine if a "safe", "unsafe", or "elevated" condition exists at any specific location.

The ***AIR PROFILE***™ guidelines developed by Environmental Analysis Associates, Inc. (EAA) use industry accepted statistical methods to compare indoor airborne sampling data collected from your project, with a large database of over 3,500 indoor samples collected from other commercial and residential buildings. A statistical summary of the data used to develop these guidelines is provided on the News and Information page of our web-site at eaalab.com. Because no industry recognized standards or published threshold mold exposure levels currently exist, performing a statistical comparison with historical indoor data collected from similar control and "problem" buildings is the best approach.

The American Conference of Governmental Industrial Hygienists (ACGIH) suggests using the 90th or 95th percentiles of baseline data (and not the arithmetic mean levels) as more appropriate metrics to assess potential exposure. This approach is described in Chapter 14.2.3.1 of the 1999 ACGIH publication entitled "*Bioaerosols Assessment and Control*". A similar approach was also used in our AIHA 2005 publication entitled *"A Regional Comparison of Mold Spore Concentrations Outdoors & Inside Clean and Mold Contaminated Southern California Buildings".*

The EAA ***AIR PROFILE***™ interpretation guidelines use our own database of over 3,500 indoor samples collected in 2017 and 2018 from the West Coast, Midwest, and East Coast regions of the country. The spore concentrations are classified into six (6) percentile frequency of occurrence ranges commonly applied to statistical exposure assessments using environmental data. The color-coded percentile ranges defined by EAA are *Typical-1* (<50th), *Typical-2* (50-75th), *Atypical-3* (75-90th), *Atypical-4* (90-95th), *Elevated-5* (95-99th), and *Elevated*-6 (>99th). The descriptive ranges and color-coding are not intended to represent or infer safe or unsafe levels. They are simply a systematic way to compare airborne mold spore concentrations collected from your building, with historical measurements from other buildings. According to the 1999 ACGIH publication, Chapter 14.2.3.1, "*investigators might decide that the new data must exceed the 90 thor 95 thpercentile of the baseline data (non-problem environments) to be considered indicative of a potential for harm".* This is a decision to be made by a trained environmental professional, and only after placing the laboratory data in context with the site-specific inspection observations made during a thorough visual inspection.

The variability in building construction, usage, and HVAC filtration need to be considered when performing any comparison. Site-specific climatic conditions can also have a direct impact on the infiltration rate and measured background of mold spores found inside buildings. The amount of vegetation in close proximity to a building can also potentially impact mold spore levels measured inside of a building through infiltration. The majority of samples in the EAA database were collected as a direct response to an indoor air quality complaint (i.e. potentially a "problem" building). As a result, there is positive bias of what the 1999 ACGIH publication refers to as "problem" buildings over "non-problem" buildings. As with most IAQ investigations there is also a third "not determined" classification that includes buildings where the specific complaints are found to be unrelated to mold or dust levels, or are simply unknown. Therefore, the exact ratio of "non problem", "problem", and "not determined" building classifications can only be theoretically estimated. The estimates for each building type are given at the bottom of last page of these guidelines.

Mold Spore Category	Description / Definition
Total Mold Spores	Total concentration of all enumerated mold spores
Aspergillus/Penicillium	Mold spores with Penicillium or Aspergillus morphology (the most common molds associated with indoor growth)
Chronic Water Indicating Fungi	Hydrophilic mold genera associated with "chronic" indoor moisture (Stachybotrys, Chaetomium, Ulocladium, Trichoderma)
Typical Outdoor Fungi	Mold genera commonly found in outdoor air (Asco/Basidiospores, Cladosporium, and other listed spores)
Hyphae fragments	Mold growth structures including hyphae (mycelia), phialides, perithecia, etc.

Note: Cladosporium may commonly grow indoors in sub-tropical climates as well as inside HVAC systems, and on window panes (from condensation). All molds genera listed can be found both indoors and outdoors. Finding low or isolated spores of any genera should be viewed as normal occurrence.

The ***AIR PROFILE***™ Comparison Summary Table in this report combines the molds into three (3) categories. The first category includes the mold genera commonly associated with outdoor infiltration including Ascospores, Basidiospores, Cladosporium, etc. The second category includes genera commonly associated with indoor growth (e.g. Aspergillus/Penicillium). The third category includes the hydrophilic "water-indicating" molds (primarily Stachybotrys, Chaetomium, Ulocladium, Trichoderma). These mold genera are common indicators of long-term water saturation or prolonged humidity. The water-indicating molds, especially Stachybotrys, are typically found at significantly lower airborne concentrations (and frequency of detection) when compared to other mold genera, even when the levels fall into the "Elevated" classifications. These separate classifications of mold genera allow the results from any building to be directly compared with the database of indoor samples independent of a comparison with outdoor sampling data. These categories are ranked by their percentile frequency of occurrence found in our 2017-2018 historical database as described above. The definition of the percentile frequency of occurrence is explained on the following page. The Aspergillus/Penicillium and Water-Indicating mold categories are commonly used as airborne indicators for the likely presence or absence of potential indoor mold growth sources. The "Outdoor Mold" category is often used as an indicator to determine if the airborne mold spores found indoors are more likely from outdoor infiltration. As stated previously, laboratory data should only be used as secondary information to support a thorough visual inspection. 26

Note: The guidelines are only applicable to occupied spaces and do not apply to wall cavities, attics, unfinished basements, crawl spaces, or other confined spaces.

AIR PROFILE™ **INDOOR MOLD SPORE INTERPRETATION GUIDELINES** doc.rev.2020-19.14/10/20

AIR PROFILE™ INDOOR AIRBORNE MOLD SPORE CLASSIFICATION GUIDELINES

2017-2018 Nationwide Database - Residential and Commercial Buildings (Mold spores/m³)

Classification/Level		Percentile Ranking	Total Spores	Aspergillus/ Penicillium	Water Indicating	* Outdoor Spores	Hyphae Fragments	Algal / Fern spores	Insect Parts
Elevated	6	>99%	>40000	>21000	>230	>16000	>340	>950	>1000
Elevated	5	>95%	>12000	>3500	>90	>8000	>170	>500	>500
Atypical	4	>90%	>6200	>1000	>50	>5000	>60	>240	>200
Atypical	3	>75%	>1600	>140	>20	>1500	>30	>140	>100
Typical	2	>50%	>400	>40	>10	>360	>15	>100	>60
Typical	1	<50%	<400	<40	<10	<360	<15	<100	<60

The concentrations in each category have been "rounded off" from the actual data generated within the 2017-2018 database

** Outdoor spores are extrapolated by not including the Aspergillus/Penicillium and Water Indicating spore categories.*

Classification/Level		Explanation	Descriptive Comments / Likely Conditions
Elevated	6	*Range found in <1% of buildings (>99th percentile)*	*Indoor mold growth / amplification and/or inadequate cleaning likely present*
Elevated	5	*Range found in <5% of buildings (>95th percentile)*	*Indoor mold growth / amplification possible, or high outdoor infiltration*
Atypical	4	*Range found in <10% of buildings (>90th percentile)*	*Infrequent cleaning, outdoor mold infiltration, isolated mold growth possible*
Atypical	3	*Range found in <25% of buildings (>75th percentile)*	*Infrequent cleaning, moderate outdoor mold infiltration*
Typical	2	*Range found in >50% of buildings (>50th percentile)*	*Typical / average buildings*
Typical	1	*Range found in <50% of buildings (<50th percentile)*	*Typical / below average building*

Although no classification system may be appropriate for all buildings, using the statistical percentile frequency of occurrence ranges as an exposure evaluation metric is consistent with industry recommended guidelines. Using this statistical method (instead of calculating the arithmetic average) ensures that a singular building with very high spore concentrations will not statistically "over-represent" buildings with very low spore concentrations. The percentile frequency of occurrence analyzes the range of collected airborne concentration measurements and determines the concentration at which a defined percentage of measurements are above and below a specified "percentile" value. For example, the 50th percentile is the value at which 50% of all measurements are both above and below that value. EAA has assigned both color-coded statistical frequency ranges and descriptions to classify exposure as shown above. The database includes ~3,500 indoor samples collected in "problem" and "non-problem" *occupied* buildings that ranged from being "clean", to having isolated water damage and/or visible mold growth. Over 1,500 outdoor samples were also collected as a part of the database. This data is summarized in a separate document. An indoor/outdoor comparison with a sub-set of this data has confirmed that a statistical correlation between simultaneously collected indoor and outdoor mold spore concentrations does not exist. In other words, using outdoor data as an acceptance/rejection or as a baseline "control" for indoor data is inherently unreliable. Outdoor samples are helpful in determining if the genera typically found outside are infiltrating into the building environment.

INTERPRETING THE INDOOR AND OUTDOOR AIRBORNE MOLD SPORE DATA IN YOUR REPORT

As described above, there is no simultaneous short-term relationship between indoor and outdoor mold/fungal spore concentrations. Using outdoor mold levels as a primary baseline comparison with indoor levels is inherently unreliable and should not be used. Outdoor airborne mold spore concentrations can vary 10-100 fold (e.g. 100 - 10,000 cts/m³) on an hour-by-hour basis depending on the sampling location, meteorological conditions, time of day, wind velocity, and seasonal variability. The indoor environment has a fewer number of variable conditions. Mold spore concentrations will typically vary no more than 2-5 fold (e.g. 500 - 2,500 cts/m³) over several weeks. The 1999 ACGIH Bioaerosols publication clearly states in Section 14.2.3.2 that *"Investigators cannot view single, paired, short-term indoor and outdoor samples as sufficiently accurate measures of fungal concentrations to allow meaningful comparisons".* Although indoor mold spore concentrations are typically lower than the "average" outdoor levels, higher measured spore concentrations indoors (even in the absence of indoor mold growth sources) is a common and normal occurrence. This is especially true in desert areas, or in northern climatic zones where vegetation sources vary significantly on a seasonal basis. Outdoor mold spore measurements are most effectively used as a potential indicator of outdoor infiltration into the indoor environment.

SUGGESTED ACTION GUIDELINES BASED ON THE MEASURED PERCENTILE EXPOSURE RANGES

1). When measurements are below the 50th percentile (Typical-1), the data should be considered typical/below average for all types of buildings.

2). When measurements are between the 50th and 75th percentile (Typical-2), the data should be considered typical/average for most HVAC supplied buildings.

3). When multiple measurements are found to be above the 75th percentile (Atypical-3), the data should be considered atypical and marginally above levels found in average buildings (HVAC and non-HVAC supplied). Further investigation may also be warranted.

4). Individual measurements exceeding the 90th (Atypical-4) or 95th percentile (Elevated-5), should be considered atypical in average buildings. The data may indicate potential indoor mold amplification or an unusual site-specific condition. Further investigation may be warranted.

5). Individual measurements above the 99th percentile (Elevated-6) should be considered a likely indicator of indoor mold amplification and require further investigation and/or remedial actions. Recommending and/or implementing additional actions requires professional judgement.

Note: The guidelines given above cannot be used to directly assess wall cavities, attics, unfinished basements, crawl spaces, or other confined spaces.

1999 -ACGIH, Bioaerosols: Assessment and Control (Chapter 14)

2005 JOEH, 2: 8-18, Daniel M. Baxter, Jimmy L. Perkins, "A Regional Comparison of Mold Spore Concentrations Outdoors and Inside "Clean and "Mold Contaminated" Southern California Buildings."

2017-2018 - Environmental Analysis Associates Database Statistical Summary (available on our website at eaalab.com)

AIR PROFILE™ INDOOR AIRBORNE DUST INTERPRETATION GUIDELINES

Based on the Environmental Analysis Associates, Inc. 2017/2018 Air Sample Database

The indoor ***AIR PROFILE***™ classification system used by EAA provides a systematic way to measure and evaluate the most common particles generated by building occupants, renovation and maintenance activities, HVAC corrosion and degradation, and the filtration efficacy in a building. This is accomplished by understanding the origin of the most common types of indoor airborne dust particle contaminants. Based on our own historical building inspections, and using the 2017/2018 historical sample database, the measured dust particle concentrations are classified in six (6) ranges (as described above) including *Typical -1* , *Typical - 2* , *Atypical -3* , *Atypical - 4* , *Elevated - 5* , and *Elevated - 6* based upon their respective percentile frequency of occurrence. In the case of "non-mold" dust categories, *Elevated* levels are usually generated by occupant or renovation activity, building component corrosion, and/or the high infiltration and prolonged deposition of outdoor dust sources. These ranges are not direct indicators of safe or unsafe conditions, nor should they be confused with EPA or OSHA exposure guidelines. The origin and potential impact of each particle category on indoor air quality is described and illustrated in Version 7 of the EAA "***Airborne and Surface Dust Analysis Interpretation Guide***" available for download on the News and Information page of our website located at eaalab.com . Additional analysis of the particle size distribution and inorganic particle chemistry can also be provided by automated SEM / X-ray analysis. The automated SEM / X-ray analysis method is also described in the airborne and surface dust interpretation guide.

The ***AIR PROFILE***™ particle classifications used by EAA are given below:

CLASSIFICATION	DESCRIPTION
Pollen	Reproductive spores of flowers
Skin cell fragments	Epithelial cells / dander
Fiberglass	Man-made fibrous glass fibers (fiberglass, mineral wool, ceramic)
Cellulose / Synthetic	Cellulosic, fabric, synthetic fibers (nylon, rayon, etc.)
Unidentified Opaque	Opaque debris (biological decay, tire rubber, corrosion, paint, etc.)
Mineral (crystalline)	Crystalline / soil minerals, construction dust particles
Fire residue	Combustion soot, ash, char, other assemblage indicator particles
* Other	Specific unusual and atypical particles
	Examples: Copier toner, paint flakes, unusual fibers, feather fibrils, starch grains, etc.
	To be handled on a case-by-case basis
(Not quantified in the summary report tables)	
Algae / Fern spores	Reproductive spores from other types of vegetation
Insect parts	Wing scales, leg or body parts of insects

AIR PROFILE™ INDOOR AIRBORNE DUST CLASSIFICATION GUIDELINES

2017-2018 Nationwide Database - Residential and Commercial Buildings (Cts/m ^{3})

Classification/Level		Percentile Ranking	Pollen	Skin Cell Fragments	Fiberglass	Cellulose / Synthetic Fibers	Unidentified Opaque	Soil / Crystalline Minerals	Fire residue / Other Particles
Elevated	6	>99%	> 40	> 30000	> 650	> 5900	> 41000	> 132000	> 54000
Elevated	5	>95%	> 35	> 15000	> 90	> 1800	> 13000	> 41000	> 9000
Atypical	4	>90%	> 16	> 10000	> 30	> 1100	> 8000	> 22000	> 4000
Atypical	3	>75%	> 8	> 6000	> 15	> 600	> 4000	> 9000	> 1400
Typical	2	>50%	> 4	> 3000	> 7	> 300	> 1800	> 4000	> 500
Typical	1	<50%	< 4	< 3000	< 7	< 300	< 1800	< 4000	< 500

The concentrations in each category have been "rounded off" from the actual data generated within the 2017-2018 database

Classification/Level		Explanation	Descriptive Comment (Most Likely Condition)
Elevated	6	*Range found in <1% of buildings (>99 th percentile)*	*Significant indoor generating sources and/or outdoor infiltration present*
Elevated	5	*Range found in <5% of buildings (>95 th percentile)*	*Indoor generating source and/or outdoor infiltration likely present*
Atypical	4	*Range found in <10% of buildings (>90 th percentile)*	*Possible indoor generating source, infrequent cleaning, inadequate filtration*
Atypical	3	*Range found in <25% of buildings (>75 th percentile)*	*Above average - Infrequent cleaning, high occupancy, outdoor infiltration*
Typical	2	*Range found in >50% of buildings (>50 th percentile)*	*Average / typical building*
Typical	1	*Range found in <50% of buildings (<50 th percentile)*	*Below average "typical" non-impacted building*

Although no exposure classification system can accurately represent all building conditions, EAA's system follows statistical guidelines outlined in Chapter 14.2.2 of the ACGIH 1999 document "*Bioaerosols: Assessment and Control*" for the comparison of airborne data. Average levels measured inside high occupancy buildings (e.g. auditoriums, classrooms, etc.), industrial environments, or buildings without routine HVAC supplied air, may have higher average ranges than indicated above. Furthermore, these guidelines are not directly applicable to the evaluation of confined spaces such as wall cavities, attics, crawl spaces, garages, or unfinished basements.

AIR PROFILE ™

INDOOR AIRBORNE EXPOSURE CLASSIFICATION SYSTEM

Indoor Airborne Mold Spore and Dust Concentrations By Region (Cts/m^3)

(Combined Commercial and Residential Buildings)

AVERAGE NATIONWIDE INDOOR PERCENTILE RANKING DATA - (Used in the EAA Comparison Summary Report)

Classification	Percentile	Total	Asp/Pen	WI	* OS	HYP	Al/Fn	Insect	Pollen	SCF	FG	CE/SYN	OPA	MIN	Fire
Elevated - 6	>99%	37562	21555	233	15774	338	949	1051	37	29900	648	5894	41325	132580	54589
Elevated - 5	> 95%	11670	3488	91	8091	169	474	526	13	14700	85	1780	12700	41290	9588
Atypical - 4	> 90%	6116	1010	46	5060	57	237	179	7	9600	29	1140	7850	22160	4323
Atypical - 3	> 75%	1640	137	23	1480	29	137	60	3	5723	8	611	3670	9090	1467
Typical - 2	> 50%	395	18	11	366	11	91	57	3	3050	4	291	1810	4400	621
Typical - 1	< 50%	395	18	11	366	11	91	57	3	3050	4	291	1810	4400	621
* Frequency of detection		88%	36%	3%	88%	21%	0.3%	0.8%	10%	99%	24%	96%	100%	100%	92%

The average nationwide combined data is used as the basis for assigning the color-coded exposure classifications in the ***AIR PROFILE*** ™ Comparison Summary Charts provided with the EAA laboratory reports. The East Coast / Midwest data and the West Coast data provided below should be considered when a more concise regional data comparison is required. * Outside molds estimated by subtracting the Asp/Pen & WI fungi from the Total spores

EAST COAST/MIDWEST INDOOR PERCENTILE RANKING DATA

Classification	Percentile	Total	Asp/Pen	WI	* OS	HYP	Al/Fn	Insect	Pollen	SCF	FG	CE/SYN	OPA	MIN	Fire
Elevated - 6	>99%	39555	25285	282	13988	576	1096	1652	27	19944	572	3409	28875	112000	37459
Elevated - 5	> 95%	13375	4520	116	8739	113	548	826	14	10900	58	1298	9506	28520	4780
Atypical - 4	> 90%	7200	1320	58	5822	57	274	341	7	8222	28	960	5908	15860	2518
Atypical - 3	> 75%	1920	169	29	1722	29	137	71	7	5080	14	549	3110	8000	993
Typical - 2	> 50%	452	18	15	419	11	91	57	7	2770	7	282	1590	4180	503
Typical - 1	< 50%	452	18	15	419	11	91	57	7	2770	7	282	1590	4180	503
* Frequency of detection		90%	38%	4%	90%	20%	0.2%	0.7%	8%	98%	25%	95%	100%	100%	91%

* Outside molds estimated by subtracting the Asp/Pen & WI fungi from the Total spores

WEST COAST INDOOR PERCENTILE RANKING DATA

Classification	Percentile	Total	Asp/Pen	WI	* OS	HYP	Al/Fn	Insect	Pollen	SCF	FG	CE/SYN	OPA	MIN	Fire
Elevated - 6	>99%	19124	9220	89	9815	576	902	488	40	43569	771	8835	75442	216830	105543
Elevated - 5	> 95%	6500	1293	61	5146	226	451	244	20	21485	114	3241	22650	78710	52772
Atypical - 4	> 90%	3550	456	30	3064	113	226	122	10	14880	50	1800	12200	36630	9893
Atypical - 3	> 75%	988	58	15	915	57	127	62	5	7530	25	819	5628	14400	2700
Typical - 2	> 50%	198	17	8	173	12	94	46	5	3715	12	373	2525	5190	1376
Typical - 1	< 50%	198	17	8	173	12	94	46	5	3715	12	373	2525	5190	1376
* Frequency of detection		84%	31%	2%	84%	23%	0.8%	1.2%	13%	99%	22%	99%	100%	100%	95%

* Outside molds estimated by subtracting the Asp/Pen & WI fungi from the Total spores

Geometric extrapolation between percentile categories was used when an insufficient number of samples were collected to establish the 90th, 95th, and/or 99th percentiles, or when a significant number of measurements are *left-censored* (i.e. the concentrations are commonly found below the limit of detection). The categories where this approach has been applied include Water-indicating (W.I.) mold spores, Hyphal fragments, Algal and fern spores, Insect parts, Pollen, and Fiberglass fibers. Note: The fire residue data is known to be positively skewed as all of the samples were collected in suspect problem buildings.

Mold / bioaerosols - Asp/Pen = Aspergillus/Penicillium, WI = Water-indicating spores, OS = Outside/outdoor spores, HYP = Fungal Hyphal/mycelia fragments
Al/Fn = Algal & Fern spores, Insect = Insect parts, SCF = Skin Cell Fragments
Other Particles - FG = Fiberglass, CE/SYN = Cellulose/Synthetic fibers, OPA = Opaque/black particles, MIN = Mineral particles, Fire = Fire residue particles
** Frequency of Detection - Defined as the percentage of samples in each category that are measured above the detection limit.*

Regional Building Distribution	Total # of buildings	%
West / Coastal (W)	345	29%
Central / Midwest (C)	100	8%
East Coast / Northeast (EC)	765	63%
Total	1210	*(Indoor sampling only)*

Estimated Problem & Non-Problem Buildings		
Problem	87	7%
Non-problem	304	25%
Not determined	819	68%

Problem Building - Known "Complaint" area or mold exposure condition with 2 or more mold samples >90th percentile range.

Non-problem building - Known "Non-complaint" area or where the data set (consisting of 3 or more samples) are less than the 75thpercentile.

*A summary of the EAA statistical database analysis and **AIR PROFILE*** ™ *exposure classification guidelines is available as a separate document.*

DUST PROFILE™

INDOOR SURFACE MOLD SPORE INTERPRETATION GUIDELINES

Statistical database of Environmental Analysis Associates, Inc. 2015 - 2019 doc.rev.2020-18.8 2/10/20

Laboratories located in Bay City, Michigan and San Diego, California

CAUTION: Laboratory results are secondary information used to support a thorough visual inspection performed by a qualified environmental professional. The EAA concentration range definitions and color-coding for both mold and dust (i.e. *Typical* , *Atypical* , or *Elevated*) are only to be used for a comparison with historical data. The ranges cannot be used as the sole criteria to infer or determine if a "safe", "unsafe" or "elevated" condition exists at a specific building location. Any representation to the contrary is a misuse of the laboratory data and suggested guidelines.

The surface mold and dust classification guidelines given below follow industry accepted guidelines for the relative comparison of exposure levels found in your building with baseline data collected from typical buildings. This database consists of over 700 samples analyzed by Environmental Analysis from a wide range of surface conditions found inside commercial and residential buildings. The percentile frequency of occurrence ranges are inherently more variable and less precise than measured air sampling results. This is due to a higher variability in deposition generated by occupant activity, space utilization, building maintenance, water intrusion / leak history, and the frequency of cleaning. The statistical ranges for mold are divided into six (6) categories defined by their percentile frequencies as Typical-1 (<50%), Typical-2 (>50%), Atypical-3 (>75%), Atypical-4 (>90%), Elevated-5 (>95%), and Elevated-6 (>99%). Exceptions to any guidelines can occur, especially in locations or climatic conditions where a very high or very low vegetation density is present.

Category	Description / Definition
Total Spores	Total concentration of all enumerated spores
Aspergillus/Penicillium	Spores with Penicillium or Aspergillus morphology
Chronic water indicating fungi	Hydrophilic fungi associated with "chronic" indoor moisture (Stachybotrys, Chaetomium, Ulocladium, Trichoderma)
Typical Outdoor Fungi	Spores commonly found in outdoor air (Asco/Basidiospores, Cladosporium, Other)
Hyphae Fragments	Fungal growth structures including hyphae (mycelia), phialides, perithecia, etc.

Note: Cladosporium may commonly grow indoors in sub-tropical climates as well as inside HVAC systems, and with condensation on window panes.

There is no direct relationship between indoor surface mold spore deposition and airborne concentrations, and very little published literature is available regarding the range of settled mold spore concentrations indoors. Based on our historical data, the variability and magnitude of settled mold spore concentrations found indoors will vary over 1,000-fold from less than 0.1 spores/mm^2 to ~100 spores/mm^2 depending on environmental factors, location, and the frequency of surface cleaning. When visible mold growth is observed, the measured spore and fungal structure concentrations (e.g. mycelia, arthroconidia, phialides, perithecia, etc.) on these surfaces will typically be greater than 100 fungal structures/mm^2, and often as high as 10,000 fungal structures/mm^2. When elevated concentrations of mold spores and growth structures are both measured, the results simply confirm the presence of mold growth. Furthermore, there is no correlation or direct relationship to how much surface area is impacted, nor can the results be used to determine if an airborne hazard is present. Analysis results (by themselves) simply indicate the presence of surface mold growth, and/or the concentration of settled spores found. Even new construction lumber and building materials can contain surface mold growth. As a result, care must be exercised when interpreting the data collected from lumber, wood products, or other materials stored outdoors prior to being used inside the building. Atypical or Elevated mold concentrations may indicate a pre-existing condition, and not necessarily mold growth or settling that occurred after the material was brought inside the building being tested. Determining the extent of actual indoor mold growth, or an elevated exposure to a moldy environment, requires a thorough visual inspection, quantification of the location and extent of surface growth, and evaluation of other environmental factors by a qualified environmental professional.

CLASSIFICATION GUIDELINES - Average Residential and Commercial Buildings (Particles / mm^2)
Database of over 500 surfaces samples collected in "Typical" Buildings

Classification	*Percentile Ranking	Total Mold Spores	Aspergillus/ Penicillium	Chronic Water Indicating	Typical Outdoor Molds	Hyphae Fragments	~ 150 "Problem" Building Samples: Total Mold Spores	Aspergillus/ Penicillium	Hyphae Fragments
Elevated - 6	>99%	>40	>6.0	>1.0	>30	>3.0	>20000	>17000	>2000
Elevated - 5	>95%	>10	>1.0	>0.2	>7.0	>1.0	>4100	>2000	>700
Atypical - 4	>90%	>5.0	>0.10	>0.10	>4.0	>0.70	>2000	>260	>120
Atypical -3	>75%	>2.0	>0.05	>0.01	>1.0	>0.05	>45	>0.1	>3.0
Typical - 2	>50%	>0.2	>0.01	>0.001	>0.10	>0.02	>4.0	>0.01	>0.02
Typical - 1	<50%	< 0.2	<0.01	< 0.001	<0.10	<0.02	<4.0	<0.01	<0.02
Frequency of detection		63%	9%	1%	63%	20%	83%	25%	38%

Elevated - 6 *Concentration range found in buildings with evidence of water intrusion or nearby mold sources*
Elevated - 5 *Concentration range found in buildings with significant spore settling, infiltration, and/or inadequate house-keeping*
Atypical - 4 *Concentration range found in buildings with infrequent house-keeping and/or outdoor infiltration*
Atypical -3 *Concentration range found in buildings with infrequent house-keeping*
Typical - 2 *Concentration range found in the average or typical building*
Typical - 1 *Concentration range found in the average "clean" building*

* *The percentile ranking estimates should only used for comparison purposes*
Some construction lumber & materials may have a natural mold background and may not indicate a current settling or growth condition.

The spore genera distribution can be used as indicators to differentiate potential indoor growth from outdoor air infiltration and subsequent settling. Indoor mold growth may be indicated when elevated Aspergillus/Penicillium genera, Water-Indicating molds, or elevated hyphae fragment concentrations are present. Occasionally, elevated concentrations of Cladosporium, certain basidiospores, or other hyaline spores may also be indicators of indoor mold growth. While no classification system will be applicable to all individual building conditions, EAA's classification ranges are based on analysis data collected over several years, and representing a wide range of commercial and residential building conditions. These classifications do not apply to non-occupied environments such as wall cavities, attics, crawl spaces, or other confined spaces.

DUST PROFILE™

INDOOR SURFACE SETTLED DUST INTERPRETATION GUIDELINES

The particle classifications used by EAA (and shown below) provide a concentration ranking of the most common dust contaminants settling on horizontal surfaces inside office and residential buildings. The particle assemblage distribution provides insight into the building's environmental and operational conditions as a result of occupant activity, renovation and construction activities, HVAC system corrosion, filtration efficiency, building furnishings, outdoor infiltration, and the adequacy of building maintenance and cleaning.

The classification ranges cannot directly be used as indicators of safe or unsafe conditions, nor should they be confused with EPA, OSHA or other government exposure guidelines. These guidelines are useful for the comparison of settled dust concentrations found inside typical or average buildings, determining the presence or absence of construction renovation related dust, or identifying other potentially irritant or allergenic particles. The analysis results can also help maintenance personnel determine the source or origin of indoor air quality complaints attributed to visible settled dust, or to evaluate the relative cleanliness of contents and surfaces. The potential association of each particle classification with building-related conditions are illustrated in the EAA "*Airborne and Surface Dust Analysis Interpretation Guide* " located on the News and Information page of our website located at eaalab.com. Additional analysis of particle size distribution and inorganic particle chemistry can also be provided by automated SEM / X-ray analysis. The automated SEM/X-ray sampling and analysis methods are also described in the interpretation guide.

Category	Description / Definition
Pollen	Reproductive spores of flowers
Skin cell fragments	Epithelial cells / dander
Fiberglass	Man-made fibrous glass fibers (fiberglass, mineral wool, ceramic)
Cellulose / Synthetic	Cellulosic, fabric, synthetic fibers (nylon, rayon, etc.)
Unidentified Opaque	Opaque debris (biological decay, tire rubber, corrosion, paint, etc.)
Soil / mineral	Crystalline / soil minerals, construction dust particles
Fire residue	Combustion soot, ash, char, other assemblage indicator particles
* Other	Specific unusual and atypical particles
	Examples: Copier toner, paint flakes, unusual fibers, feather fibrils, starch grains, etc.
	To be handled on a case-by-case basis
(Not quantified in the summary report tables)	
Insect parts	Wing scales, leg or body parts of insects
Algae/Fern spores	Reproductive spores from other types of vegetation

CLASSIFICATION GUIDELINES - Average Residential and Commercial Buildings (Particles / mm^2)

Database of over 500 surfaces samples collected in "Typical" Buildings

Classification	Approximate Percentile Ranking	Pollen	Skin Cell Fragments	Fiberglass	Cellulose / Synthetic Fibers	Unidentified Opaque	Soil / Crystalline Minerals	*Suspect problem Buildings Only* Fire Residue	* Other
Elevated - 6	>99%	>10	>260	>3.0	>75	>700	>900	>3360	
Elevated - 5	>95%	>2.0	>150	>1.0	>50	>130	>240	>1680	> 50
Atypical - 4	>90%	>1.0	>110	>0.7	>25	>60	>140	>388	>25
Atypical -3	>75%	>0.3	>35	>0.1	>10	>20	>60	>4.0	>10
Typical - 2	>50%	>0.0	>12	>0.03	>3.0	>7.0	>15	>0.04	>3.0
Typical - 1	<50%	<0.04	<12	<0.03	<3.0	<7.0	<15	<0.04	<3.0
Frequency of detection		33%	96%	26%	93%	98%	99%	Not measured	

* *Reported individually under the "Special Comments Section" - Concentration ranges may vary by type of particle*

Elevated - 6 *Concentration range found in buildings with significant indoor generating sources and/or significant infiltration*

Elevated - 5 *Concentration range found in buildings with likely indoor generating sources and/or significant infiltration*

Atypical - 4 *Concentration range found in buildings with possible generating sources and/or inadequate filtration*

Atypical -3 *Concentration range found in average buildings with infrequent cleaning and/or possible outdoor infiltration*

Typical - 2 *Concentration range found in the average / typical building*

Typical - 1 *Concentration range found in the average "clean" non-impacted building with frequent cleaning.*

EAA's classification system follows basic guidelines outlined in Chapter 14.2.2 of the ACGIH 1999 document *Bioaerosols: Assessment Control* by using the approximate percentile frequency occurrence of baseline data collected inside office and residential buildings. No classification system can be expected to directly apply to all types of building environments. In general, surface dust levels measured inside buildings using significant window ventilation or outside unfiltered air will be significantly higher than other buildings. Conversely, settled dust levels measured inside well filtered HVAC supplied indoor environments (e.g. hospitals, clean rooms) should expected to be significantly lower. The classification ranges are not directly applicable to the assessment of wall cavities, confined spaces, crawl spaces, or unfinished basements.

EXAMPLE LABORATORY REPORTS

EXAMPLE AIRBORNE MOLD AND DUST REPORT

ENVIRONMENTAL ANALYSIS ASSOCIATES, INC. - 306 5th Street, Suite 2A - Bay City, MI 48708

AIRBORNE MOLD AND DUST ANALYSIS

EAA Method # : DUST-A01

Client Name : ABC Environmental
Client Project # : 19-1000 Project description : 123 Elm Street
Requested by : Mr. John Doe Date collected : 11/1/19
EAA Project# : 19-2000 Sample received : 11/2/19

Sample condition : *Acceptable as received*

Client Sample#	Sample Description / Location	* General Comments - Dust and Mold Spore Levels	
ABC-001	Office 1 - Control	Typical dust	Typical - low mold spores
ABC-002	Office 2 - West wing	Typical dust	Typical - low mold spores
ABC-003	Office 3 - East wing - complaint area	Atypical fire residue	Elevated Aspergillus/Penicillium mold spores
ABC-004	Lobby entrance	Typical dust	Atypical mold spores
ABC-005	Outside front door	Overloaded with dust	Elevated outdoor mold spores

AIRBORNE MOLD SPORE CONCENTRATIONS (Cts./m^3) -- Spore Trap Sample Analysis *High mag. used 500X*

Category Sample # -->	ABC-001	ABC-002	ABC-003	ABC-004	ABC-005
Total Mold Spores (Cts/m^3)	**640**	**1010**	**7450**	**2510**	**15200**
Alternaria				91	137
Aspergillus/Penicillium	137	229	6400	274	137
Ascospores	91	229	137	457	1140
Basidiospores	229	274	229	686	9140
Botrytis					
Chaetomium				91	
Cladosporium	137	137	457	686	4340
Curvularia					
Drechslera/Bipolaris					
Epicoccum					
Fusicladium-like					
Nigrospora					
Oidium/Peronospora					
Pithomyces					46
Rusts					
Smuts / Myxomycetes / Periconia			46	91	183
Stachybotrys			183	91	
Stemphylium					
Torula					
Ulocladium					
Other Hyaline Fungi	46	91		46	46
Other Fungi					
Unidentified Fungi		46			
Hyphae fragments		46		91	457
Algal / fern spores					
Insect parts				46	229
POLLEN (Total cts/m^3)	**13**	**not detected**	**13**	**67**	**426**
Not specified			13	27	93
Mixed grasses/ragweed	13			40	333
COMMON AEROSOLS (cts/m3)					
Skin cell fragments	6860	8000	25100	5490	686
Fiberglass fibers	11	46	366	46	46
Cellulosic / synthetic fibers	229	1140	2970	229	229
Unidentified opaque	1600	5030	6400	5030	10100
Mineral / clay soil dust	6400	9140	16000	16000	137000
OTHER PARTICLES (cts/m3)	**137**	**91**	**2831**	**183**	**915**
	91		1140	91	229
			91		
	46	91	1600	91	686
Statistical Parameters					
Vol. analyzed (m3)-high mag - 500x :	0.022	0.022	0.022	0.022	0.022
Detect limit(Cts/m^3)-high magnification:	45.7	45.7	45.7	45.7	45.7
% sample analyzed-high magnification:	29%	29%	29%	29%	29%
Vol. analyzed(m^3)/entire sple 150-300x :	0.075	0.075	0.075	0.075	0.075
* Detection limit (Cts/m^3)/entire sple:	13.3	13.3	13.3	13.3	13.3
* Note: The "entire sample" detection limit applies to the "large" particle categories analyzed during the low magnification examination of the entire sample					
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):	0.420	0.420	0.420	0.420	0.420

Note: Sample results are only applicable to the items or locations tested. Sample descriptions and volumetric data are provided by the client. *doc.rev.2019-18 11/11/19*

** See the **AIR PROFILE** ™ Interpretation Guidelines for the appropriate application of the exposure classification definitions of Typical, Atypical, and Elevated.*

Raw/extrapolated counts are given on the last page of this report as a requirement of the AIHA-LAP accreditation program

Authorized / data reviewed by: *Joseph R. Heintskill*
Analyst : *jlj*

Report date: **11/4/19**
Date analyzed: 11/4/19

AIRBORNE MOLD AND DUST ANALYSIS

EAA Method # : DUST-A01

(Mold and Dust Comparison Summary - Cts/m^3)

Client Name : ABC Environmental

Client Project # : 19-1000 | Project description : 123 Elm Street

Requested by : Mr. John Doe | EAA Project# : 19-2000

Sample # Description	Mold Spores * Total	Aspergillus / Penicillium	Chronic W.I. Fungi	Outdoor Spores	Hyphae Fragments	Pollen	Skin cell Fragments	Fibrous Dust Min. wool / Fiberglass	Fibrous Dust Cellulose/ Synthetic	Non-Fibrous dust Unident. Opaque	Non-Fibrous dust Crystalline Minerals	Fire Residue
ABC-001 Office 1 - Control	640	137		503		13	6,860	11	229	1,600	6,400	137
ABC-002 Office 2 - West wing	1,010	229		777	46		8,000	46	1,140	5,030	9,140	91
ABC-003 Office 3 - East wing - complaint area	7,450	6,400	183	869		13	25,100	366	2,970	6,400	16,000	2,831
ABC-004 Lobby entrance	2,510	274	183	2,060	91	67	5,490	46	229	5,030	16,000	183
ABC-005 Outside front door	15,200	137		15,000	457	426	686	46	229	10,100	137,000	915

Level	Percentile
Elevated - 6	>99%
Elevated - 5	>95%
Atypical - 4	>90%
Atypical - 3	>75%
Typical - 2	>50%
Typical - 1	<50%

** Note : All individual particle category values are rounded to 3 decimal places. As a result, individually summed mold categories may appear slightly different than the "Total" value*

Chronic water indicating fungi (W.I.), include the genera Chaetomium, Stachybotrys, Ulocladium, and Trichoderma. The hyphae fragments category includes hyphae (mycelia), phialides, perithecia, etc. In order for chart clarity, cells where the particle category was not detected are intentionally left blank.

*The **AIR PROFILE**™ reporting format developed by EAA is a systematic and statistically concise way to summarize and compare your indoor sampling data, with historical indoor data collected from a large database of other buildings (as recommended by the 1999 ACGIH document,"Bioaerosols Assessment and Control"). The color-coded exposure ranges used by EAA are Typical-1, Typical-2, Atypical-3, Atypical-4, Elevated-5, and Elevated-6. The ranges are based on the percentile frequency of occurrences measured from the EAA 2017/2018 database of over 3,500 residential and commercial building samples collected throughout the United States. The resulting data should be used in combination with a thorough visual inspection conducted by a qualified environmental professional to determine if an indoor air quality problem is present.*

EXAMPLE DATA SUMMARY PAGE FOR THE AIRBORNE DUST REPORTS

EXAMPLE SURFACE MOLD AND DUST REPORT

ENVIRONMENTAL ANALYSIS ASSOCIATES, INC. - 306 5th Street, Suite 2A - Bay City, MI 48708

SURFACE MOLD AND DUST ANALYSIS

EAA Method # : DUST-D01

Data Page 1 of 4

Client Name : ABC Environmental
Client Project # : 20-1005
Requested by : Mr. John Doe
EAA Project# : 20-3010

Project : 520 Main Street - Mold complaint office 102
Date collected : 1/14/20
Date received : 1/17/20

Sample condition : *Acceptable as received*
Magnification 200X

Client Sample#	Sample Description / Location	* General Comments - Dust and Mold Spore Levels	
T1	Lobby entrance	Typical - low dust	Typical - low mold spores
T2	Office 101 - desk - Control	Typical - low dust	Typical - low mold spores
T3	Office 102 - Desk - Complaint	Elevated mixed dust	Elevated Aspergillus/Penicillium spores
T4	Office 110 - Desk - Back of building	Atypical dust	Atypical Aspergillus/Penicilium spores
T5	Storage room - Shelf - Back of building	Elevated mixed dust	Atypical Aspergillus/Penicilium spores

SURFACE MOLD SPORE CONCENTRATIONS (Cts./mm^2)

Category Sample # -->	T1	T2	T3	T4	T5
Total Mold Spores (Cts/mm^2)	**2.6**	**0.3**	**12.1**	**3.2**	**7.2**
Alternaria	0.1		0.2		
Aspergillus/Penicillium	0.2	0.1	11.4	2.2	1.6
Ascospores	0.3			0.4	
Basidiospores	0.5			0.3	1.1
Botrytis					0.5
Chaetomium			0.1		
Cladosporium	0.8			0.2	1.6
Curvularia					
Drechslera/Bipolaris					0.2
Epicoccum	0.1				0.1
Fusicladium-like					
Nigrospora					
Oidium/Peronospora					
Pithomyces					
Rusts					
Smuts / Myxomycetes / Periconia	0.4				1.4
Stachybotrys			0.3		
Stemphylium					
Torula					
Ulocladium					
Other Hyaline Fungi	0.1	0.2			0.3
Other Fungi					
Unidentified Fungi					0.2
Hyphae fragments	0.3		4.9	0.2	0.5
Algal / fern spores					
Insect parts	0.1		0.2		0.8
POLLEN (Total cts/mm^2)	**0.9**	**0.1**	**0.3**	**0.1**	**2.4**
Not specified					0.2
Mixed Pinus / grasses	0.9	0.1	0.3	0.1	2.2
COMMON AEROSOLS (cts/mm2)					
Skin cell fragments	13.1	18.5	273.0	49.1	218.0
Fiberglass fibers	0.1	0.1	0.4		0.5
Cellulosic / synthetic fibers	2.7	4.9	10.5	6.0	10.4
Unidentified opaque	11.1	2.7	49.1	3.8	27.3
Mineral / clay soil dust	7.1	11.4	27.3	8.2	32.7
OTHER AEROSOLS (cts/mm2)	**not detected**	**not detected**	**not detected**	**not detected**	**not detected**

Statistical Parameters					
Area analyzed (mm^2)--mold/aerosols:	9.17	9.17	9.17	9.17	9.17
Detect limit(Cts/mm^2)--mold/aerosols:	0.11	0.11	0.11	0.11	0.11
Raw Count Conversion Factor :	9.17	9.17	9.17	9.17	9.17
Microscopic fields counted :	10	10	10	10	10
Microscope field area (mm^2):	0.92	0.92	0.92	0.92	0.92

Note: Sample results are only applicable to the items or locations tested. Sample descriptions and volumetric data are provided by the client. doc.rev.2020-19.1 4/10/20

Authorized / data reviewed by : *Joseph R. Heintskill* Date: **1/18/20**

Analyst : *jlj* Date analyzed: 1/18/20

** See the **DUST PROFILE** ™ Interpretation Guidelines for the exposure classification definitions (Typical, Atypical, Elevated).*

IMPORTANT : Laboratory results are secondary information used to support a thorough visual inspection performed by a qualified environmental professional. The EAA concentration levels defined as "Atypical" or Elevated" cannot be used as a primary criteria to determine if a "safe", "Elevated", or "unsafe" condition exists.

SURFACE MOLD AND DUST ANALYSIS

(Mold and Dust Comparison Summary - Cts/mm^2)

EAA Method # : DUST-A01

Client Name : ABC Environmental

Client Project # : 20-1005

Project description : 520 Main Street - Mold complaint office 102

Requested by : Mr. John Doe

EAA Project# : 20-3010

Sample # Description	Mold Spore * Total	Chronic Aspergillus / Penicillium	Chronic W.I. Fungi	Outdoor Spores	Hyphae Fragments	Pollen	Skin cell Fragments	Fibrous Dust Min. wool/ Fiberglass	Fibrous Dust Cellulose/ Synthetic	Non-Fibrous dust Unident. Opaque	Non-Fibrous dust Crystalline Mineral	Other Particles
T1 Lobby entrance	2.6	0.2		2.4	0.3	0.9	13.1	0.1	2.7	11.1	7.1	
T2 Office 101 - desk - Control	0.3	0.1		0.2		0.1	18.5	0.1	4.9	2.7	11.4	
T3 Office 102 - Desk - Complaint	12.1	11.4	0.44	0.2	4.9	0.3	273.0	0.4	10.5	49.1	27.3	
T4 Office 110 - Desk - Back of building	3.2	2.2		1.0	0.2	0.1	49.1		6.0	3.8	8.2	
T5 Storage room - Shelf - Back of building	7.2	1.6		5.6	0.5	2.4	218.0	0.5	10.4	27.3	32.7	

All individual particle category values are rounded to 3 decimal places. As a result, individually summed mold categories may appear slightly different than the "Total" value.

Range	Percentile
Elevated-6	>99%
Elevated-5	>95%
Atypical-4	>90%
Atypical-3	>75%
Typical-2	>50%
Typical-1	<50%

Chronic water indicating fungi (W.I.), include the genera Chaetomium, Stachybotrys, Ulocladium, and Trichoderma. The hyphae fragments category includes hyphae (mycelia), phialides, perithecia, etc. In order for chart clarity, cells where the particle category was not detected are intentionally left blank.

*The EAA **DUST PROFILE**™ reporting format is a systematic and statistical way to summarize and compare indoor sampling data. The descriptive color-coded ranges developed by EAA are Typical-1, Typical-2, Atypical-3, Atypical-4, Elevated-5, and Elevated-6. The ranges are based on the percentile frequency of occurrence found in our historical database of residential and commercial buildings collected throughout the United States. The classifications cannot be directly used as an indicator of indoor contamination, or of a safe or unsafe environment without a thorough visual inspection by a qualified environmental professional.*

EXAMPLE FIRE RESIDUE ANALYSIS REPORT

ENVIRONMENTAL ANALYSIS ASSOCIATES, Inc. - 306 5th Street, Suite 2A - Bay City, MI 48708

FIRE/COMBUSTION RESIDUE & DUST ANALYSIS - Optical Microscopy Method: FIRE-D02

Client Name : ABC Environmental
Client Project # : 18-1050
Requested by : Mr. John Smith
Project Description : Warehouse storage area
Client Sample # : T1
Client sample description : Source- I Beam
Sample collected : 11/5/19
Sample received : 11/6/19
Sample media : tape

EAA Project # : 18-0066
EAA Sample # : T1
Analysis magnification : 200x
Fields counted : 5
Field area (mm^2) : 0.917
Area counted (mm^2) : 4.59

SUMMARY CONCLUSIONS : Fire/combustion residue concentration measured above typical background concentrations
Qualitative observations confirm the presence of indicator fire/combustion particles

QUALITATIVE / ASSEMBLAGE OBSERVATIONS -Reflected & Polarized Light Microscopy (10-500x)		
Lab sample description	Black powdery dust	
Smoke or fire odor present ?	Yes	
Large char (>500µm) or soot cluster (>50µm) particles observed ?	Yes	
Large ash-like particles observed ?	Yes	
Wildfire or structure fire indicator/signature particles present?	Yes	Indoor fire indicators

	FIRE / COMBUSTION RESIDUE CONSTITUENTS	Particle Concentration Cts/area (mm2)	Estimated Area Ratio %
	Totals	**136.9**	**24.3 %**
	Aciniform / soot-like fine particles	121.7	9.0
	Char (Pyrolized plant material)	1.7	3.1
	Ash-like mineral residue particles	0.4	0.5
Indoor fire indicators	Burned synthetic fibers, plastics, other	13.1	11.7
	INORGANIC CONSTITUENTS		
Fibrous Constituents :	Cellulosic / synthetic fabric fibers	5.5	48.6
	Fiberglass fibers	0.4	0.6
Non-fibrous Constituents :	Mixed inorganic mineral dust / soil	19.6	4.4
	Other opaque particles	10.5	7.8
	BIOAEROSOLS		
Mold Spores / Structures :	Unspecified	3.3	0.5
Pollen :	Unspecified	0.4	0.4
Plant fragments :	Flower parts, trichomes, etc.	not detected	not detected
Animal fragments :	Dander / skin cells	9.8	13.1
Miscellaneous :	Unspecified	0.2	0.3
	OTHER CONSTITUENTS		
Biogenic / organic debris :	Unspecified	not detected	not detected

Raw/extrapolated particle count : 856
* Area adjusted "count" total : 247
Detection Limit (Area ratio %) : 0.4
Detection Limit Cts/mm2 : 0.2

Authorized / data reviewed by : *Joseph R. Heintskill* *12/07/19*

Analysis date : *11/8/19*
Analyst initials : *jlj*

* *The summed concentration total of converting individual numerical raw or extrapolated particle counts to an area equivalent count based on the average particle "area" of each category. This "count" provides a reference total for directly estimating the area % of each particle category.*

The local geographic background, site specific conditions, and other potential combustion sources must be taken into account in order to determine if an elevated or atypical condition is present. The estimated surface particle concentrations per unit surface area (Cts/mm2) can only be calculated on surface tape lift samples.

Note: Sample results are only applicable to the items or locations tested.

ENVIRONMENTAL ANALYSIS ASSOCIATES, Inc. - 306 5th Street, Suite 2A - Bay City, MI 48708

Fire/Combustion Residue Data Summary Table

Client : ABC Environmental
Client Project # : 18-1050
Client Project Description : Warehouse storage area
EAA Project # : 18-0066

Sample#	Sample Description	Fire / Combustion Particle Concentrations Estimated Area Ratio % Total	Soot	Char	Ash-like	Oth. Indicator Particles	* Surface Density (Cts/mm^2)	Are large fire residue particles detected ?	Are wildfire or structure fire indicator particles present?	Are there any potential interferences present?
T1	Source- I Beam	24.3	9.0	3.1	0.5	11.7	136.9	Yes	Yes	
T2	Source- I Beam-2	17.2	3.5	9.8	not detected	3.9	56.8	Yes	Yes	Yes
T3	Office 1 - desk surface - control	0.6	0.1	0.5	not detected		2.6			
T4	Lunch area - wall discoloration	5.0	3.5	1.5	not detected		12.2			
T5	Storage box - warehouse near source	17.8	5.1	7.7	not detected	5.0	137.3	Yes	Yes	Yes

The "Estimated Area Ratio %" is the numerical "size/area adjusted" ratio between all particle categories based on the average estimated area of each particle category.

The "Surface density (Cts/mm2)" of fire residue particles is the numerical surface particle concentration independent of the amount or ratio of background dust.

** Note: If the surface particle density of fire residue particles (cts/mm2) is not displayed, it was not analyzed due to significant sample overloading, or could not be performed on the collection media submitted for analysis. The surface density of fire combustion particles can only routinely be calculated on tape lift samples that are not "overloaded" with dust.*

The color-coded guideline ranges for "Typical-Low", "Typical-upper bkg" (Upper background), "Atypical" (Above typical background), or "Elevated" (indicative of a combustion source) are based on the variance of background levels (area ratio% and cts/mm2) measured by EAA in buildings. The local geographic background, site specific conditions, and other potential combustion sources must be taken into account in order to determine if an elevated or atypical fire/combustion residue condition is present. The laboratory test results are secondary support information to be used in conjunction with a thorough visual inspection and conclusions provided by a qualified environmental professional.

Fire / Combustion Residue Concentrations

Ratio % & Surface Concentrations		
Classification Range	Total Fire Particle ratio%	Total Fire Particle cts/mm^2
Elevated	>10%	>50
Atypical	3-10%	5-50
Typical-upper bkg	1-3%	1-5
Typical-low	<1%	<1

EXAMPLE DATA SUMMARY PAGE FOR FIRE RESIDUE REPORTS

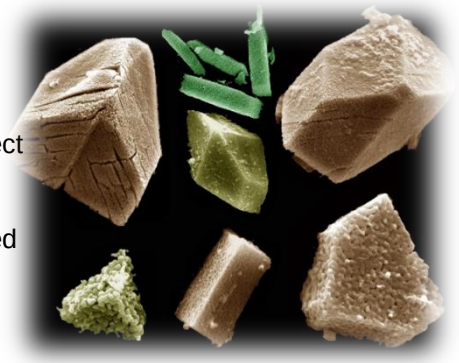
AUTOMATED SEM / X-RAY DUST ANALYSIS PROCEDURES

Specialized testing offered by Environmental Analysis Associates

Environmental Analysis Associates, Inc. operates two laboratory facilities located in Bay City, Michigan, and San Diego, California. Both facilities are equipped with automated Scanning Electron Microscopes and specialized X-ray particle analysis software specifically designed to identify the source and cause of the indoor air quality complaints.

The data collected by the SEM and EDAX™ Particle™" X-ray software is converted into a statistical report format developed by EAA. The analysis reports provide particle size distribution and elemental chemistry analysis designed for use by environmental health professionals. The reports provide direct estimates of quantitative sample chemistry, mass and size distribution, including mass estimates of respirable and inhalable sized dust (e.g. $PM_{2.5}$ and PM_{10}).

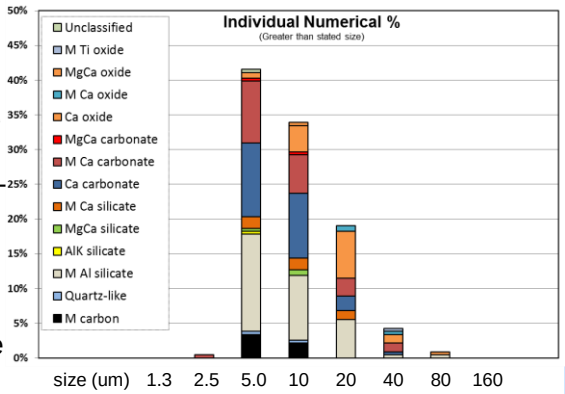
SAMPLE COLLECTION METHODS

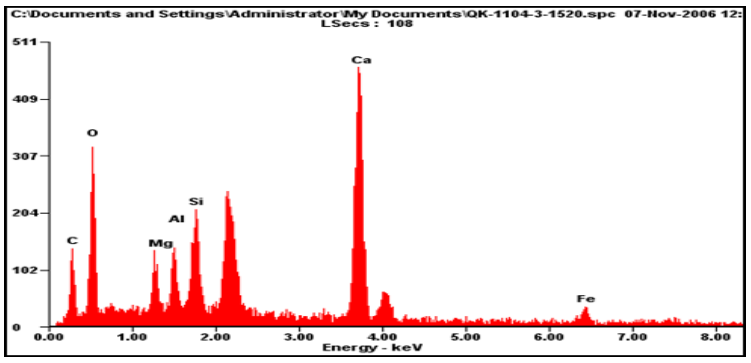


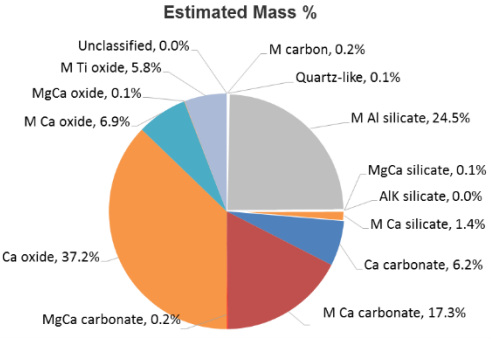
Different types of sample collection media can be used depending on the type of sample being analyzed. Bulk, vacuum, or adhesive tape lift media can be used to collect surface dust samples. The direct preparation of adhesive tape media is the preferred procedure to evaluate settled dust samples. Water samples can be filtered using 0.4µm polycarbonate filter media. Airborne samples can be collected using polycarbonate filters or Zefon™ Air-O-Cell CSI™ slit impaction samplers that contain adhesive media compatible with the SEM and Dispersive X-ray analysis.

ANALYSIS METHOD SUMMARY

The SEM analysis method is utilized as a semi-quantitative diagnostic testing procedure to estimate the size and Elemental distribution of individual particles within a surface dust, airborne dust, or water sample. The method is well-suited to simultaneously provide gravimetric mass measurements when chemistry information cannot be collected by using conventional methods. Optical Microscopy methods are recommended for the analysis of biological fibers and particles (mold, pollen, etc.) and not SEM analysis. A flow diagram for the suggested use this method is given on page 8 of this document.







AUTOMATED SEM/X-RAY DUST ANALYSIS PROCEDURES

Table of the most common sources and classification of indoor inorganic dust particles

The following are the most common examples of how materials are classified in the automated SEM report:

Material Description	Naturally Occurring?	Building Source/Composition	Common X-ray Classifications
Common Building Components			
Carbonaceous	Y - common	Biological synthetic particles fibers	M carbon **
Asphaltic	N	Roofing / patching	S carbon
Quartz	Y - common	Concrete, sand, plasters	Quartz-like, Si oxide
Mixed silicate clays	Y - common	Soil infiltration, plasters, insulation	M Al silicate **
Vermiculite	N	Spray on insulation (variable)	M Al silicate (special)**
Calcium sulfate	Y - rare	Drywall board / compounds	Ca sulfate
Calcium carbonate	Y - low	Concrete, patching compounds	Ca carbonate
Calcium silicate	Y - low	Concrete, patching compound, plasters	Ca silicate
Magnesium silicate	N	Concrete, patching compound, plasters	Mg silicate
Calcium / Magnesium silicate	N	Concrete, patching compound, plasters	MgCa silicate
Titanium Paints	N	Coatings - Wall, ceiling tiles, etc	M Ti oxide **
Corrosion Particles			
Iron oxide	Y - moderate	Pipes, motors, HVAC components	Fe oxide
Al oxide	Y - moderate	HVAC, ducting, brackets, windows	Al oxide
Zn oxide	N	Galvanized HVAC coatings	Zn oxide
AlZn oxide	N	HVAC ducting / components	AlZn oxide
Mixed Aluminum/ Iron oxide	N	HVAC components / drip pans	AlFe oxide
Mixed Aluminum/ Iron/Copper oxide	N	Mixed HVAC components	AlFeCu oxide
Mixed Iron/Chromium Oxide	N	Steel corrosion particles	CrFe oxide
Cu oxide	N	Copper piping	Cu oxide
Combustion Residue Particles			
Soot / char particles	Y	Heated carbonaceous components	H carbon
Vegetation ash	Y	Residual mineral salts–combustion	Ca,Mg,K oxides
Plant phytoliths	Y	Outdoor infiltration – vegetation	Ca, Si oxides

It is important to note that most materials are not “pure” and minor amounts (1-5%) of other common elements are usually found in association with each classification.

* The particle minor element chemistry and morphology occasionally needs to be considered to classify the particles appropriately

** An “M” prefix refers to “mixed” element classification (e.g. M carbon for mixed carbon)

SEM / X-RAY PARTICLE CLASSIFICATION SYSTEM

BASIC PARTICLE "CLASSIFICATION" RULES FOR COMMON DUST SAMPLES

CLASSIFICATION	DESCRIPTION	* Approximate Wt. %/Size (ZAF) "Guidelines" *Note: Values must be adjusted for particles <3um*	
CARBONACEOUS	Biogenic and organic	Primary	Secondary
H carbon	High carbon (only minor amounts of other elements)	C >80%	All other <3% (except O)
M carbon	Moderate/mixed carbon (only minor amounts of other elements)	C >50%	All other <10% (except O)
N carbon	Carbon (minor amount Nitrogen >5%)	C >50%	N > 5%
"Cl,Si,Ba,S," carbon	Moderate carbon with 2 or less element combinations	C >50%	Other >5%
SILICATES	Construction materials / soil minerals		
Quartz-like	Quartz / Quartz-like - Predominant Si & O / low carbon	Si >20%, O>20%	Other <5%
M Al silicate	Aluminum Silicates - Predominant Al Si	Al >3%, Si >10%	Other <5%
Fe Al silicate	Aluminum silicate - Significant Iron present	Al>3%, Si>10%	Fe >5%
Ca silicate	Calcium silicate - Ca / Si wi. absence of signficant carbon	Al>3%, Si>10%	Ca >5%
K Al silicate	Possible feldspar minerals (Orthoclase) / other	Al>3%, Si>10%	K >5%
Ca Al silicate	Possible feldspar minerals (Plagioclase) / other	Al>3%, Si>10%	Ca >5%
M silicate	Mixed silicate with 3 or more cation elements other than Si	Si >10%, O>20%	Cations >5%
CARBONATE	Construction materials / soil minerals		
Ca Carbonate	Calcium Carbonate	Ca>15%,	C<50%
MgCa Carbonate	Magnesium Calcium Carbonate (2 predominant)	Ca / Mg >10%	C<50%
Ca oxide	Calcium oxide / oxalate	Ca>30%	C<20%, O >25%
M carbonate	Carbonate - Mixed with 3 or more elements none predominant	All cations 3-5%	C>30%, O>20%
SULFATE	Construction materials / precipitated salts		
Ca sulfate	Calcium sulfate (drywall dust)	Ca>10%, S>5%	Other <3%
Na sulfate	Sodium sulfate - efflouresence salts	Na>10%, S>5%	Other <3%
MgCa sulfate	Magnesium/Calcium sulfate (2 predominant)	Mg/Ca>10%, S>10%	Other <3%
Ba sulfate	Barium sulfate	Ba>10%,S>10%	Other <3%
Zn sulfate	Zinc sulfate (Zinc, Sulfur and Oxygen)	Zn>10%,S>10%	Other <3%
M sulfate	Sulfate - Mixed with 3 or more elements none predominant	S>10%	Other cations >5%
SULFIDE	Reducing enviroment particles (Low oxygen)		
C sulfide	Carbon sulfide (very low oxygen)	C>50%, S>10%	Other <3%
Na sulfide	Sodium sulfide	Na>10%, S>10%	O <20%, Other <3%
Zn sulfide	Zinc sulfide	Zn>10%, S>10%	O <20%
M sulfide	Sulfide - Mixed with 3 or more elements not predominant	Cation>10%, S>5%	Other cations <5%
CHLORIDE	Evaporated salts or water induced metal corrosion		
Na chloride	Sodium chloride	Na>10%, Cl>10%	C & O <20%
NaMg chloride	Sodium / magnesium salts (2 predominant)	Na/Mg >10%	C & O <20%
M chloride	Chloride - Mixed with 3 or more elements none predominant	Cation>10%, Cl>5%	C & O <20%
OXIDE	Corrosion particles / possible fire "ash" (see next page)		
Quartz (Si oxide)	See silicate category		
Ca oxide	Calcium oxide - Construction materials / oxalate fire ash	Ca>30%, O>20%	C < 20%
Na oxide	Likely evaporated sodium hydroxide	Na>30%, O>20%	C < 20%
Al oxide	Aluminum oxide - pos. corrosion / mineral	Al>30%, O>20%	C < 30%
Fe oxide	Iron oxide - pos. corrosion / mineral	Fe>15%, O>20%	C < 50%
Zn oxide	Zinc oxide - Corrosion	Zn>15%, O>20%	C < 50%
AlZn oxide	Aluminum and Zinc oxide - Pos. corrosion	Al / Zn >15%	C < 50%
Cu oxide	Copper oxide	Cu>15%, O>20%	C < 50%
M Al,Fe,Zn, oxide	3 specific metals present	All >5%	C < 50%
M oxide	Oxide - Mixed with 3 or more elements none predominant	3 or more cations >5%	
UNCLASSIFIED / MIXED ELEMENTS			
Unclassified	Composition not identifiable		
M composition	Mixed composition 5 + elements/mixed agglomerate composition (i.e. mixed carbonate/sulfate/silicate)		

**** Wt% guidelines can vary based on particle geometry and background of the carbon substrate.***

Note: This classification system is designed as a systematic way to generally categorize (classify), and define the gross composition of an individual particle. The "classification" is first assigned based on the visual rank order elemental predominance in the X-ray spectrum. A chi-square classification fit of 65-75% is used. The name given to the "classified" particle is based on the most likely mineralogy found in the natural or indoor environment. The "classification" combinations may not always correctly define the exact composition of a particle, or always correctly represent the rank order quantitative elemental chemistry. Multiple sets of elemental ratio rules are used for "small" verses "large" particles due to increased beam penetration in particles smaller than 5um into the Carbon/Oxygen adhesive substrate. This limitation affects the measured apparent elemental stoichiometry. A 2no manual review of particle spectra is conducted to verify particle ID.

AUTOMATED SEM ANALYSIS REPORT

Example Data Summary Page

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

Automated Scanning Electron Microscopy Dust Analysis - Summary Report

Surface/Bulk Dust Analysis - Quantitative

Client Name : ABC Environmental
Contact : Mr. John Doe
Client Project# : ABC18-1000
Client Sample # : B-2
Sample Description : Montecito Fire Ash - background sample
Sample media / type code : Surface/Bulk dust analysis
Analysis Magnification : 147
Scale (µm/div.) : 1
Total particles counted : 211

Analysis Method : *SEM-D01*
Sample collected : *11/1/18*
Sample received : *11/1/18*
EAA Project # : 18-3131
EAA Sample # : 3131-2
Fields / passes counted : 3
Field area counted (mm^2) : 1.549

Particles / mm^2 : 136
Particles/sampled area : 210

Min./Max. size range (µm) : 5.0 / 2000

Est. particle thickness ratio (S:I) : 1

SUMMARY CONCLUSIONS

The Montecito fire ash sample contains a distribution consistent with moderate concentrations of Magnesium, Potassium, and Calcium oxides and carbonates (~26% by mass). The high concentrations of large clay particles (M Al silicate, MgAl silicate) are also an indication of high concentrations of soil mineral particles. High concentrations of ash fragments and plant phytoliths are also visible in the backscatter electron images given in photo report on page 2.

Numerical & Mass % Concentration Summary — *Mass within analyzed area only*

Particle Classification	# Cted	Mean (µm)	Num. %	*Calc Mass %	*Spec Grav	* Part. / sampled area	Part. / mm^2	*Theoretical ug / mm2	Calc.Mass ug / cm2
M carbon	46	11.2	21.8%	11.8%	1.50	46	30	1.0	103.6
Quartz-like	5	17.5	2.4%	0.4%	2.00	5	3	0.0	3.1
M Al silicate	72	20.0	34.1%	35.6%	2.00	72	46	3.1	312.2
AlK silicate	15	16.0	7.1%	1.0%	2.00	15	10	0.1	8.9
MgAl silicate	22	31.5	10.4%	21.7%	2.00	22	14	1.9	189.9
KCa silicate	1	22.8	0.5%	0.1%	2.00	1	1	0.0	0.8
Ca silicate	1	13.4	0.5%	0.0%	2.00	1	1	0.0	0.2
Ca oxide	11	24.6	5.2%	10.5%	2.00	11	7	0.9	92.3
MgKCa oxide	10	30.6	4.7%	15.9%	2.00	10	6	1.4	138.9
KCa oxide	3	9.3	1.4%	0.0%	2.00	3	2	0.0	0.2
MgCa oxide	8	17.1	3.8%	0.4%	2.00	8	5	0.0	3.9
M Ca carbonate	9	19.0	4.3%	2.4%	2.00	9	6	0.2	20.9
Cu metal	1	16.8	0.5%	0.04%	2.00	1	1	0.0	0.3
Fe oxide	3	10.6	1.4%	0.04%	2.00	3	2	0.0	0.4
Unclassified	2	11.3	0.9%	0.1%	2.00	2	1	0.0	0.5
TOTALS	209					210	136		880.0

** The theoretical calculated mass is based on the sum total of each particle volume & theoretical specific gravity.*
Calculations assume an estimated thickness ratio and should be used as rough comparative mass estimates only.
All "classifications" are presumptive and represent the most likely common mineral or chemical present.
All calculated values are rounded to 3 significant figures, and should be considered accurate to 2 significant figures.

Authorized / data reviewed by : *Daniel M. Baxter* Date : *11/16/18*
Analyst : *DMB* Date analyzed : *11/15/18*

Sample results are only applicable to the items or locations tested.
Sample descriptions and volumetric data are provided by the client.

AUTOMATED SEM ANALYSIS REPORT
Example Photo Page

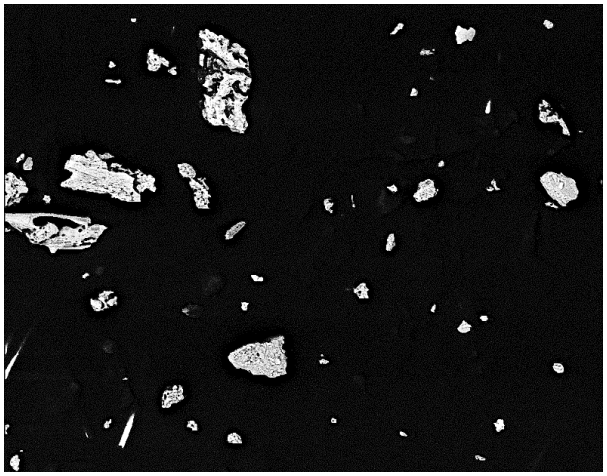
ENVIRONMENTAL ANALYSIS ASSOCIATES, Inc. - 5290 Soledad Road - San Diego, CA 92109 - (858) 272-7747

Automated Scanning Electron Microscopy - Dust Analysis Photo Report

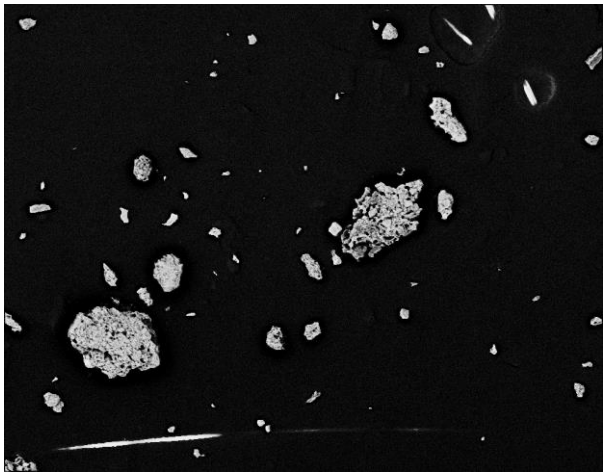
Client Name : ABC Environmental
Contact : Mr. John Doe
Client Project# : ABC18-1000
Client Sample # : B-2
Sample Description : Montecito Fire Ash - background sample
Analysis Method : Surface/Bulk dust analysis

Sample received : 11/1/18
EAA Project # : 18-3131
EAA Sample # : 3131-2

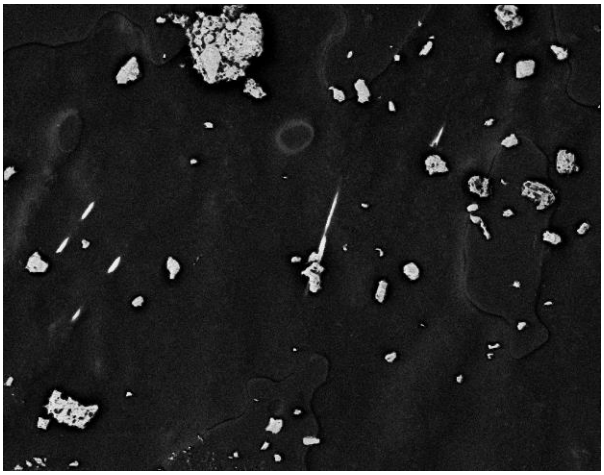
Backscatter electron image
Sample Magnification 147



Field 1



Field 2



Field 3

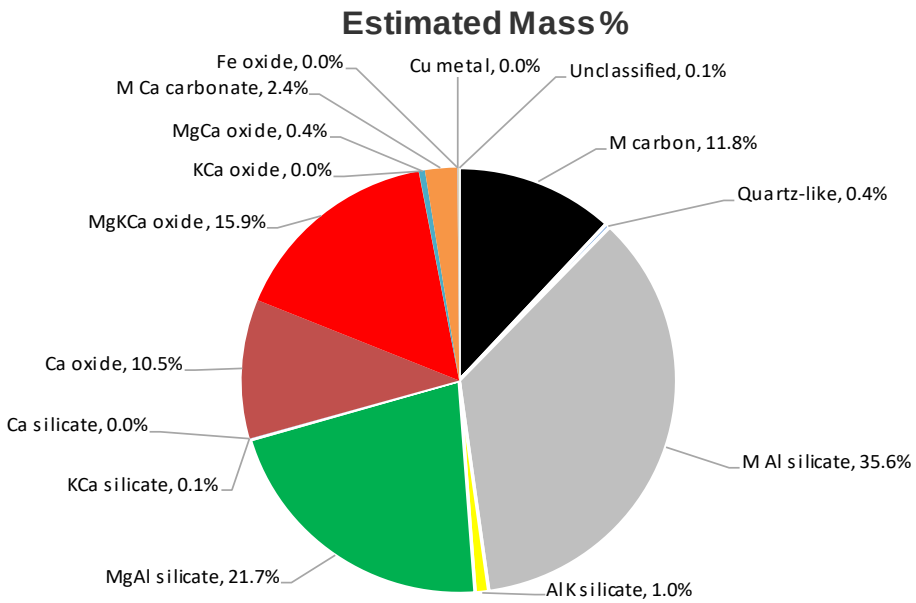
AUTOMATED SEM ANALYSIS REPORT
Graphical report

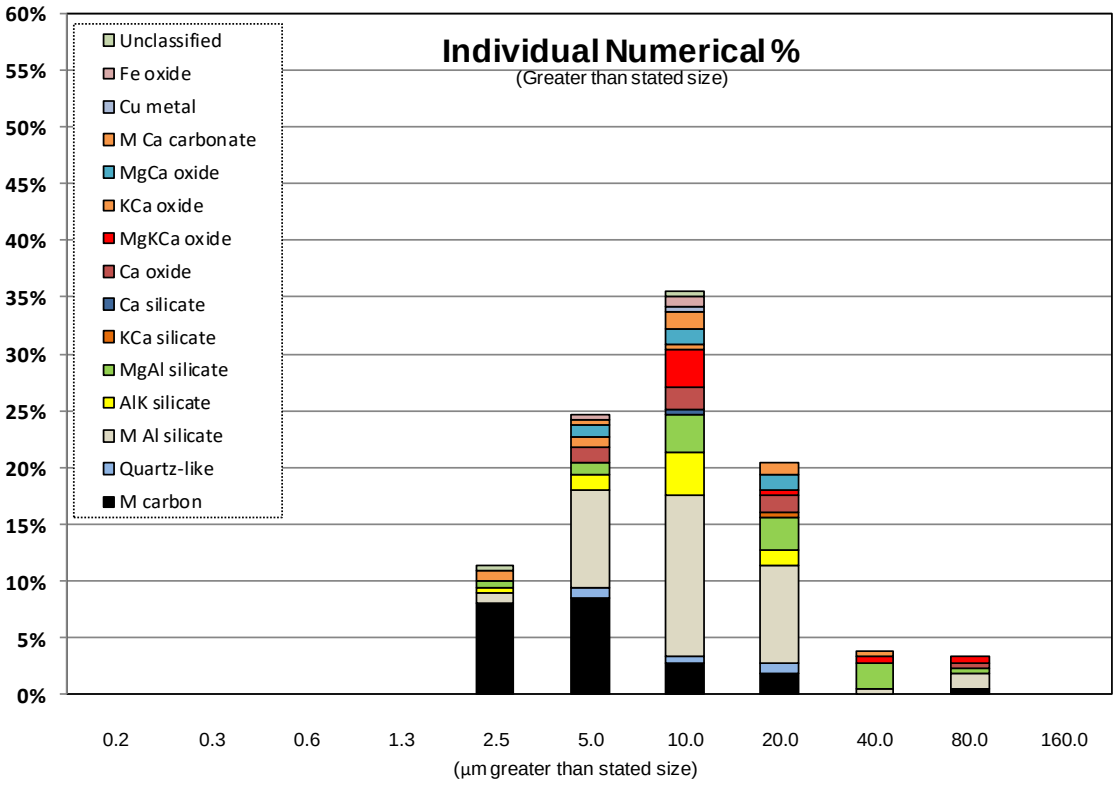
ENVIRONMENTAL ANALYSIS ASSOCIATES, Inc. - 5290 Soledad Road - San Diego, CA 92109 - (858) 272-7747

Automated Scanning Electron Microscopy -Grapical Report - Mass & Size Distribution

Client Name : ABC Environmental
Contact : Mr. John Doe
Client Project# : ABC18-1000
Client Sample # : B-2
Sample Description : Montecito Fire Ash - background sample
Analysis Method : Surface/Bulk dust analysis

Sample received : 11/1/18
EAA Project # : 18-3131
EAA Sample # : 3131-2
EAA Method # : SEM-D01





AUTOMATED SEM ANALYSIS REPORT

Example Graphical X-ray Data Page

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

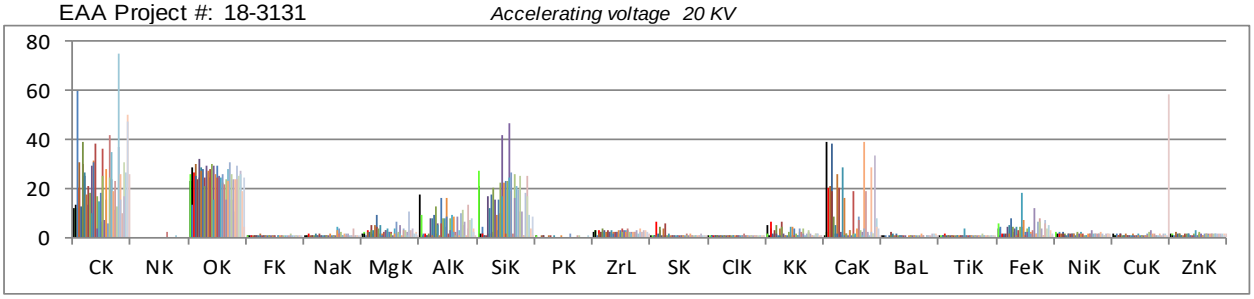
PARTICLE CHEMISTRY - GRAPHICAL REPORT

(Elemental Composition - Weight %)

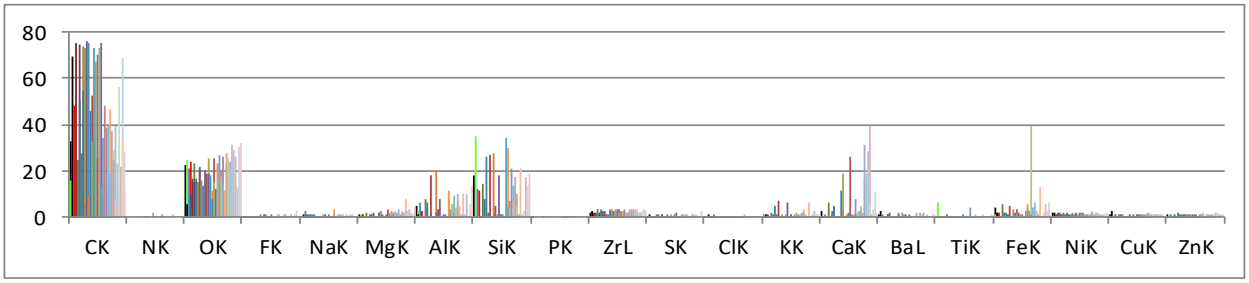
Cambridge S-240 SEM equipped with EDAX Octane SDD detector

Client Name: ABC Environmental Client Sample # : B-2

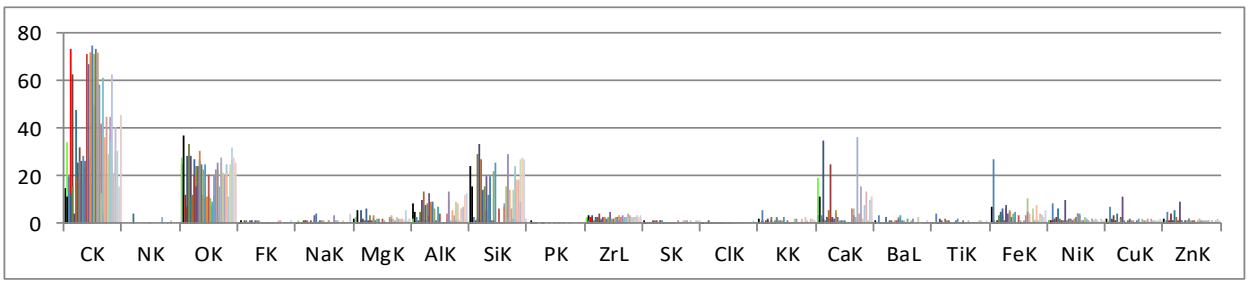
EAA Project #: 18-3131 *Accelerating voltage 20 KV*



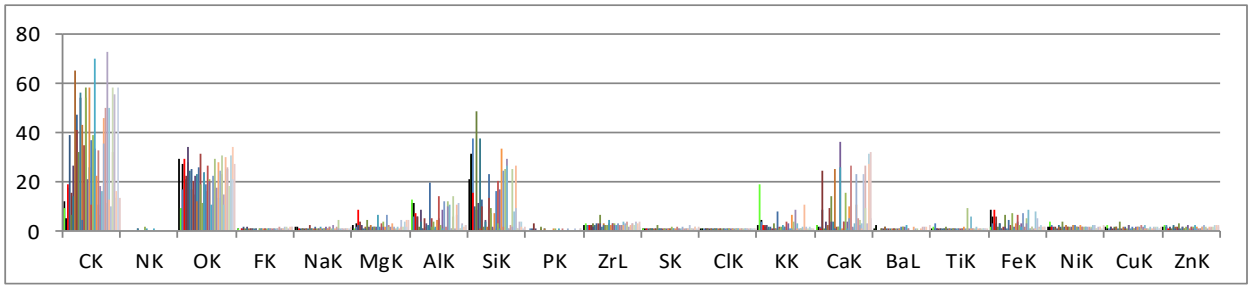
Particles 1-50



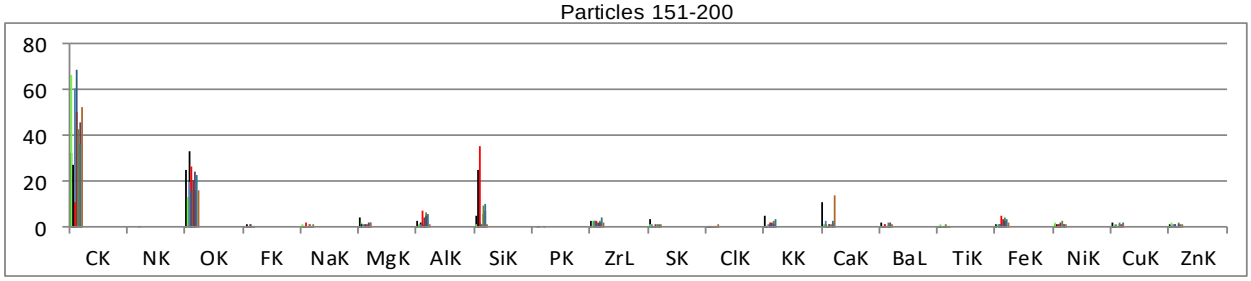
Particles 51-100



Particles 101-150



Particles 151-200

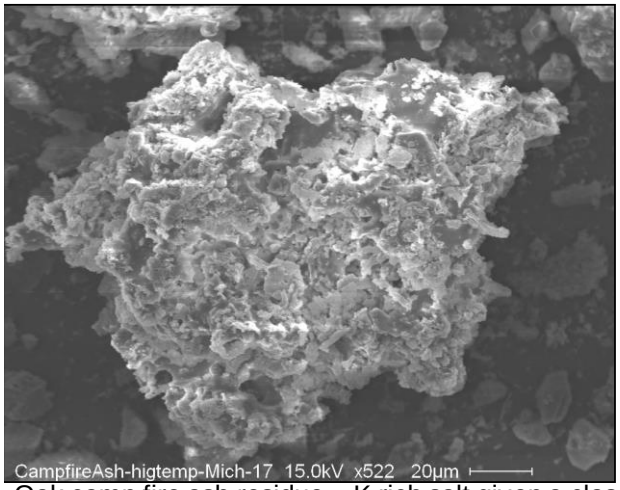


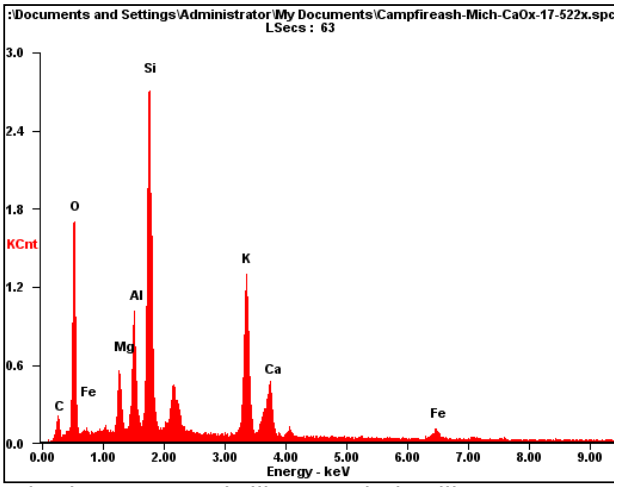
Particles 201-250

Note: X-axis is the element category followed by the electron shell used for quantification (e.g. "Na" element, "K" k electron shell)

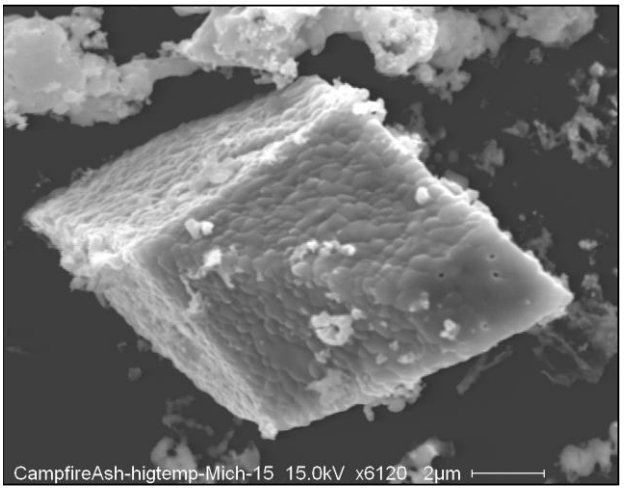
COMMON EXAMPLE PARTICLES

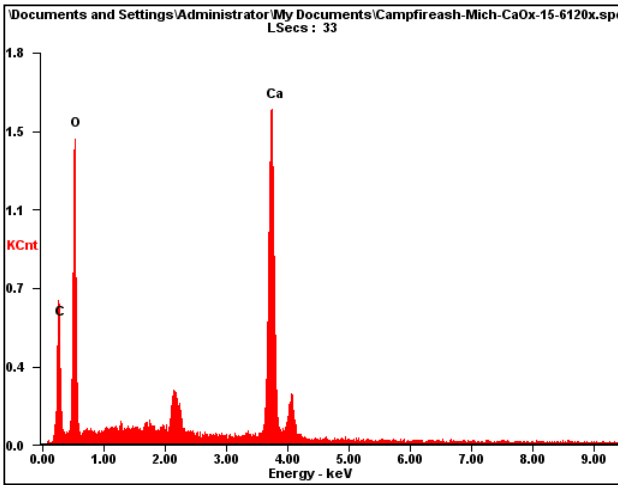
Example particle images & X-ray spectra



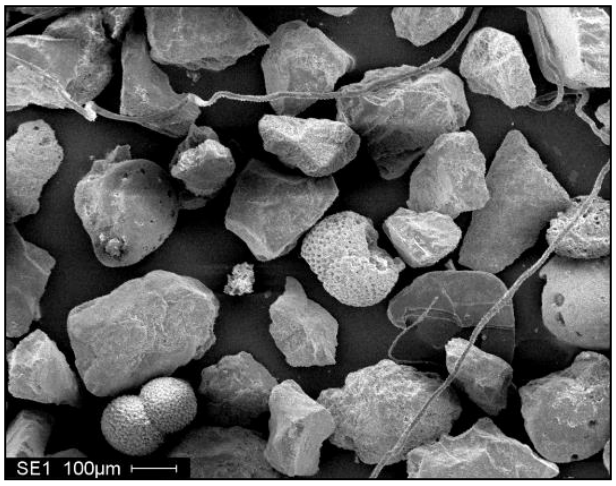


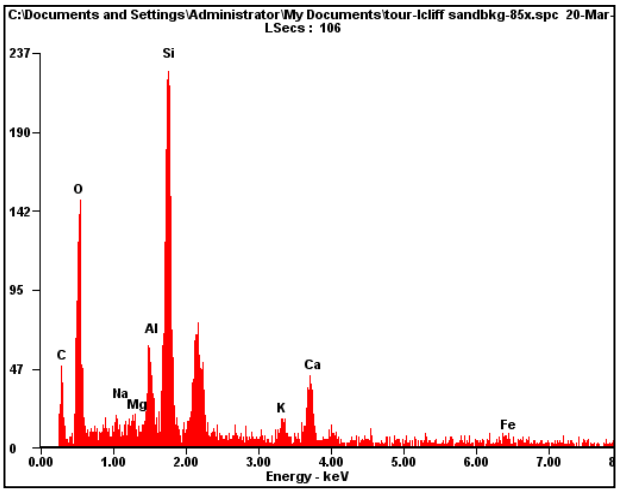
Oak camp fire ash residue – K rich salt given a classification between M Al silicate and AlK silicate





Oak camp fire ash – Calcium oxalate phytolith (Ca oxide / oxalate)

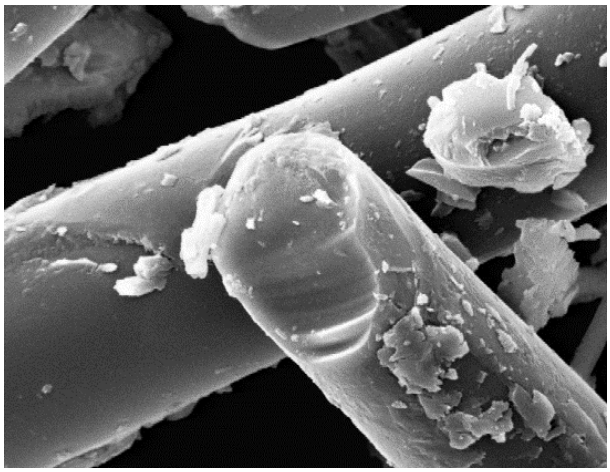


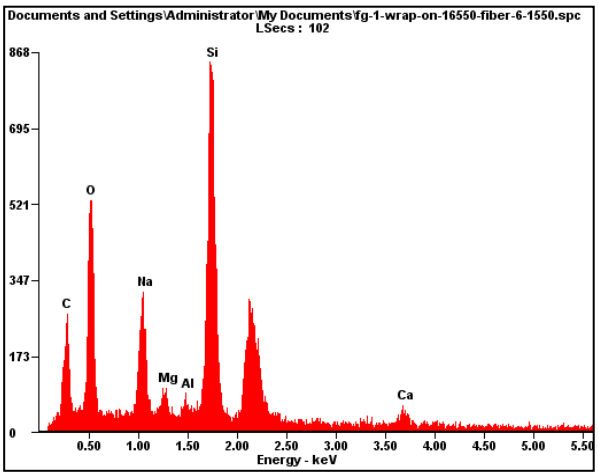


Fossiliferous beach sand Tourmaline Beach, San Diego - >125um sieved size fraction

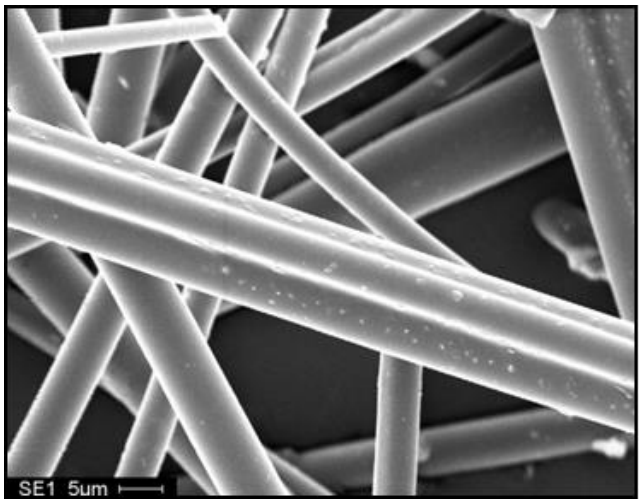
COMMON EXAMPLE PARTICLES

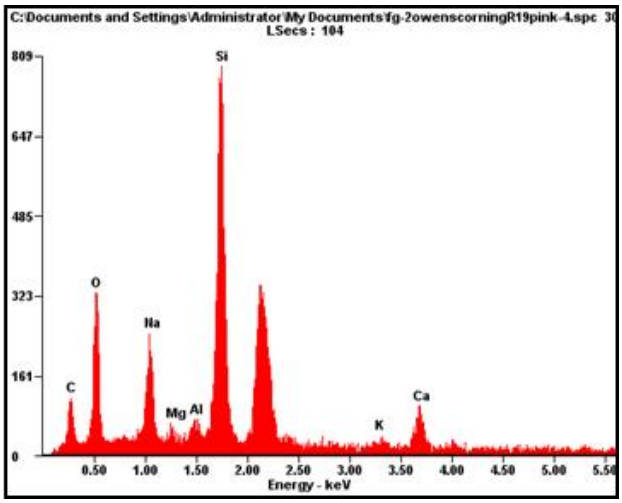
Example particles images & X-ray spectra – Fiberglass insulation fibers



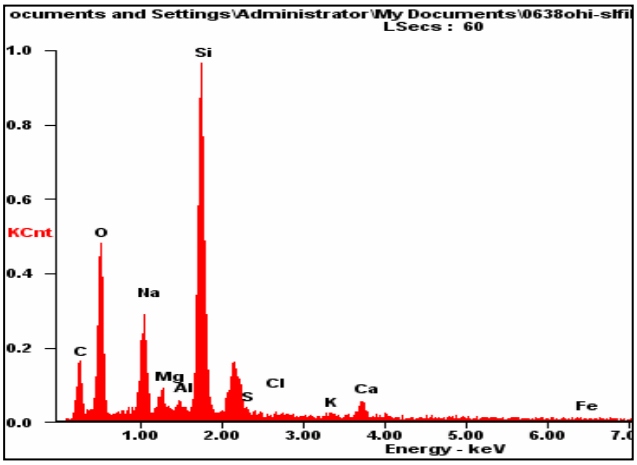


Wrap-on Fiberglass insulation #16550. High Na, low Ca glass





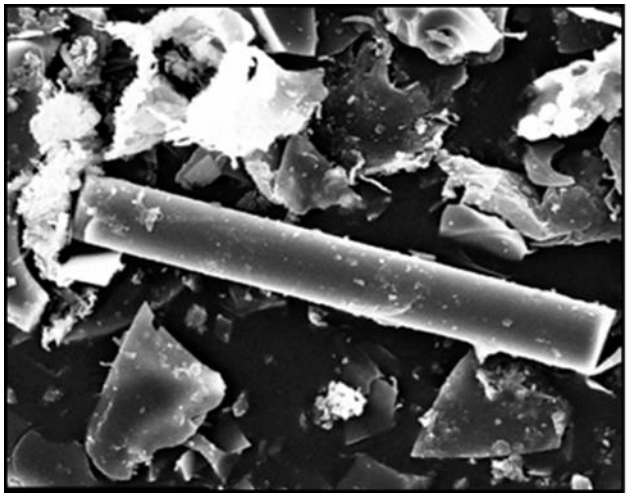
Owens Corning Pink insulation R-19 . High Na, moderate Ca glass

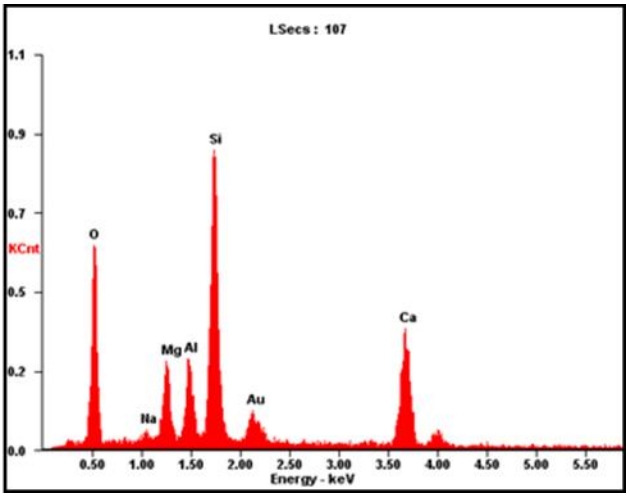


Sound liner fiberglass from HVAC system mixing box (optical microscopy)- 600x

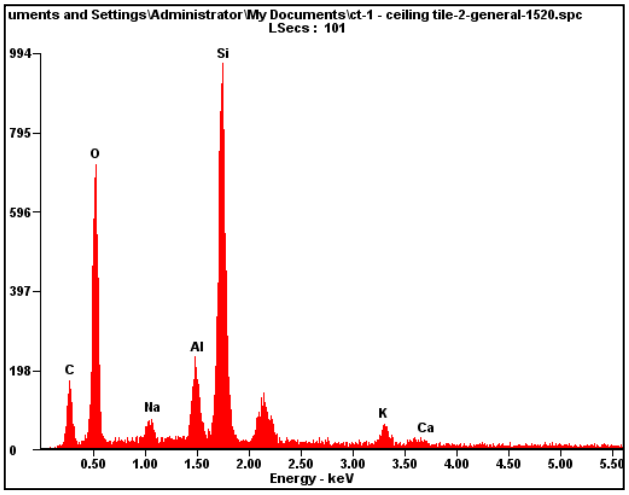
COMMON EXAMPLE PARTICLES

Example particles images & X-ray spectra – Drop ceiling tile dust

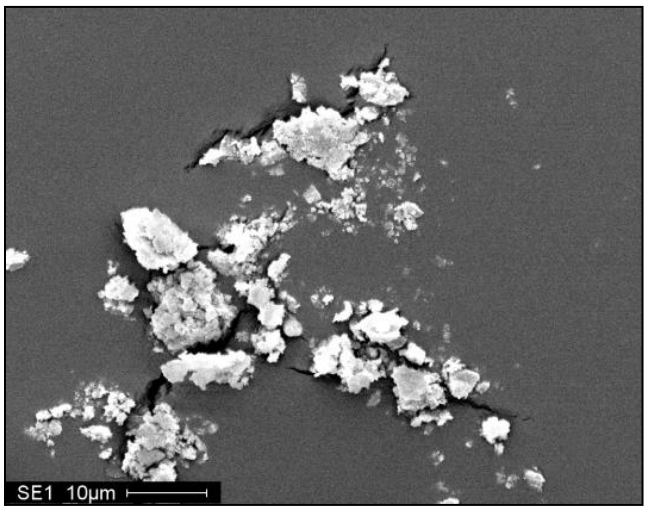


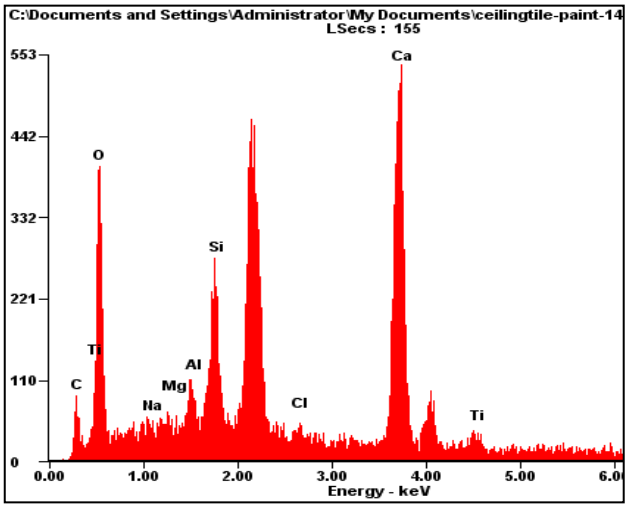


Fiberglass fibers in ceiling tiles. High Ca, low Na



"Crushed" perlite material from ceiling tile

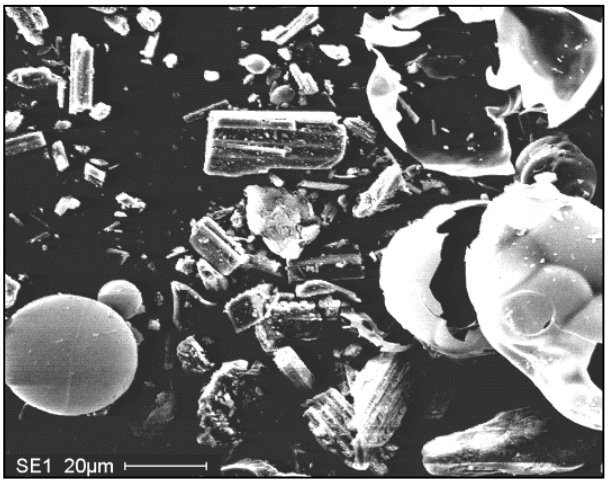


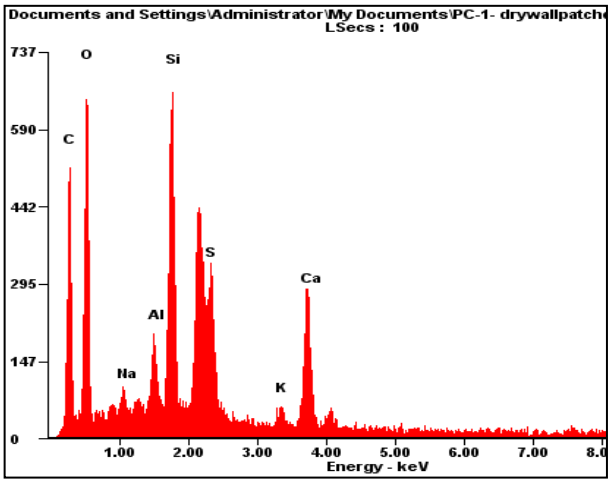


Paint from ceiling tile surface

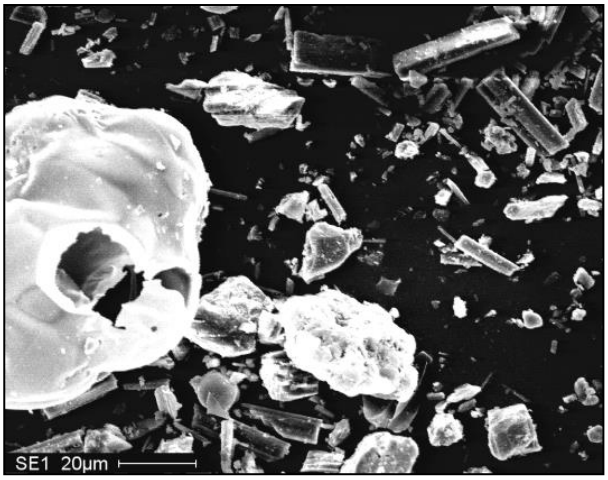
COMMON EXAMPLE PARTICLES

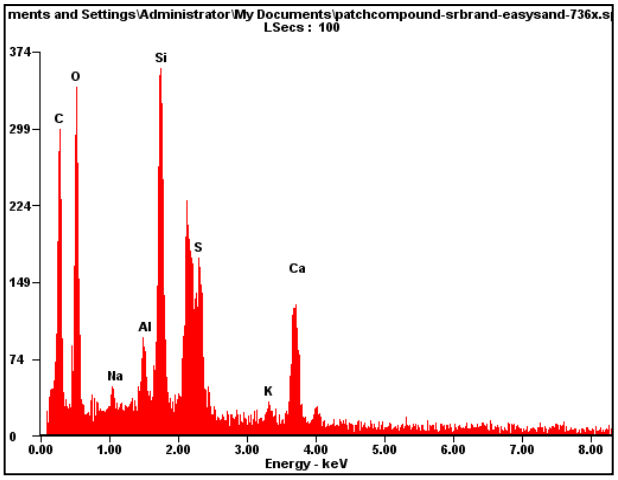
Example particles images & X-ray spectra – Drywall patching compounds



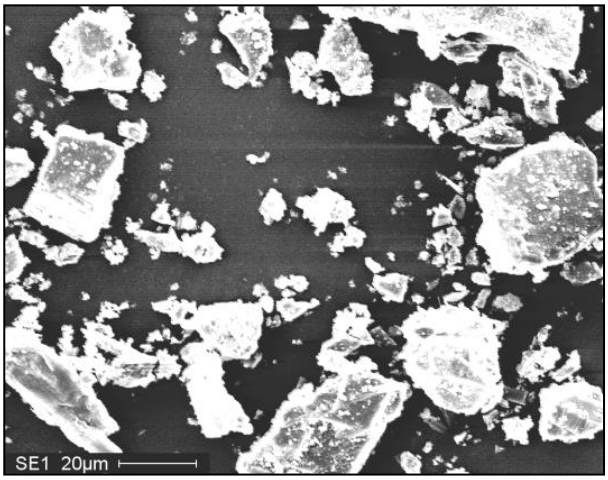


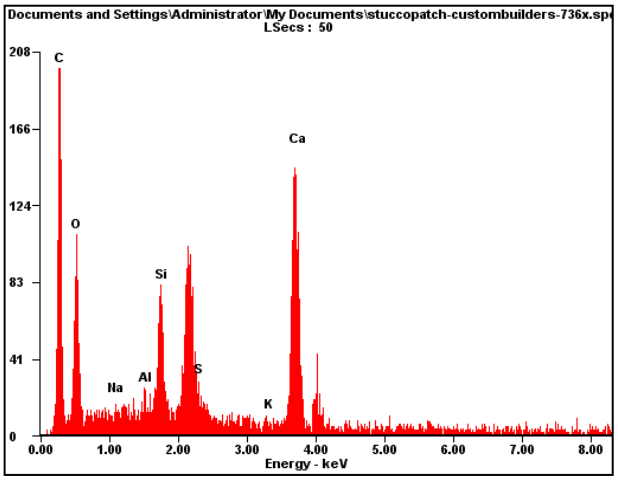
PC – 1 Drywall patch – 736x





Sheetrock Easy Sand Brand 736x

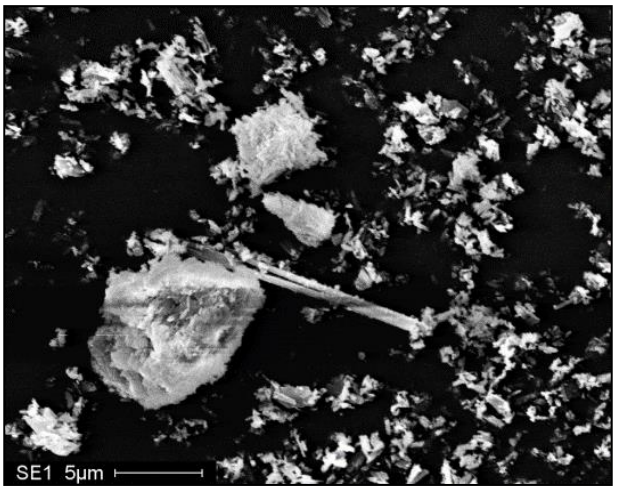


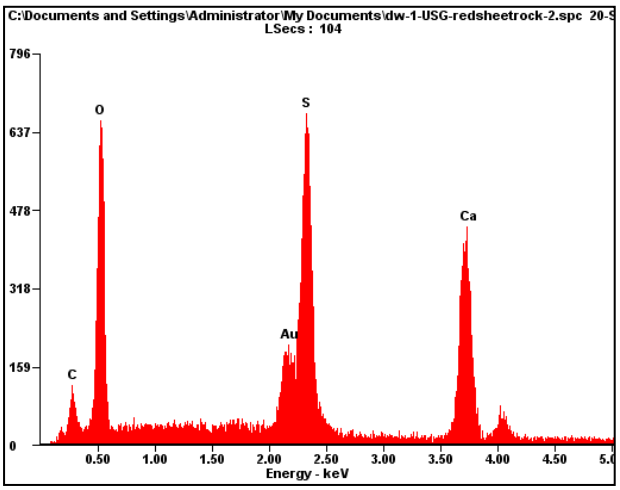


Stucco Patch – Custom Builders – 736x

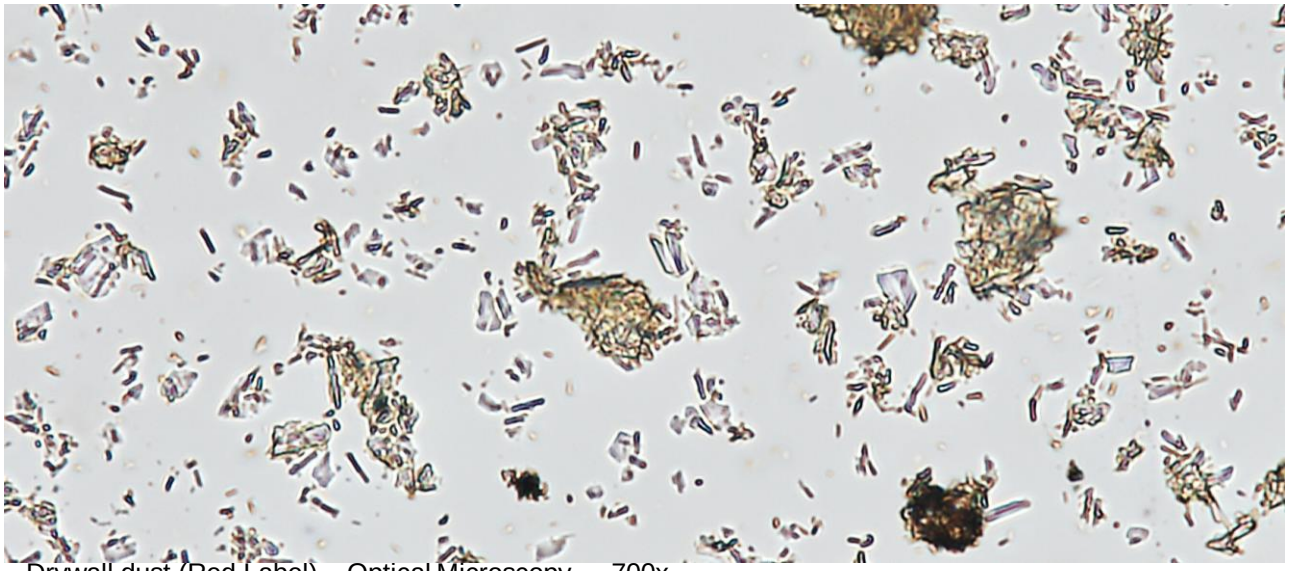
COMMON EXAMPLE PARTICLES

Example particles images & X-ray spectra – Drywall Material

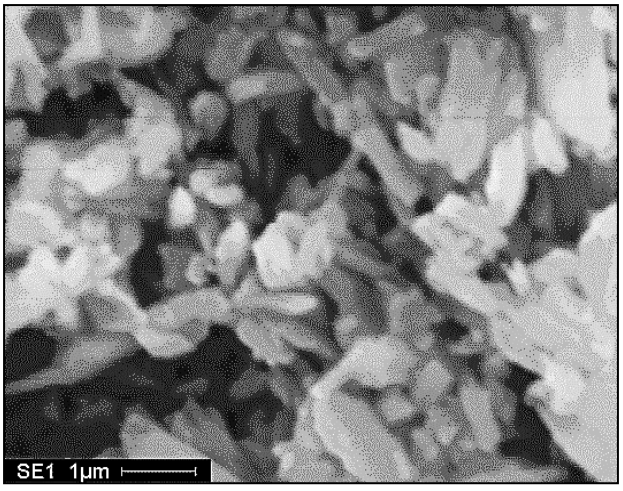


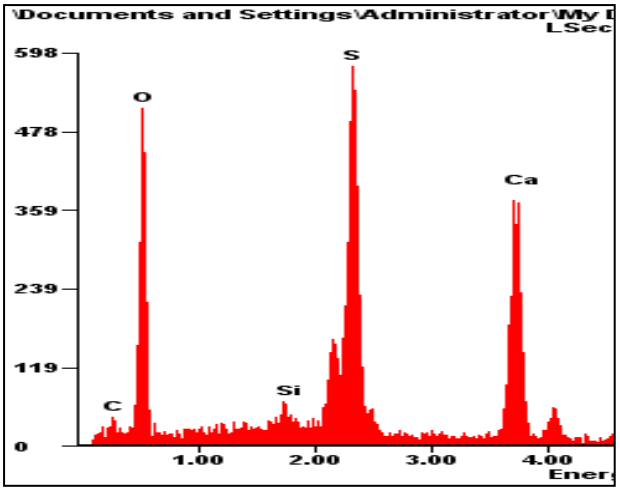


US Gypsum (Red label) - Calcium Sulfate – 400x



Drywall dust (Red Label) – Optical Microscopy - ~700x

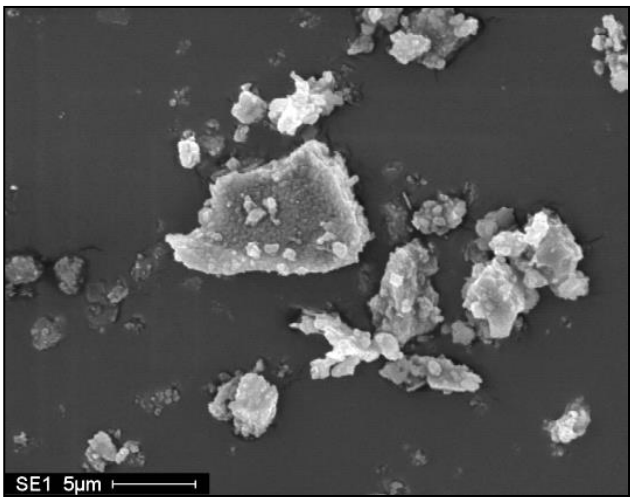


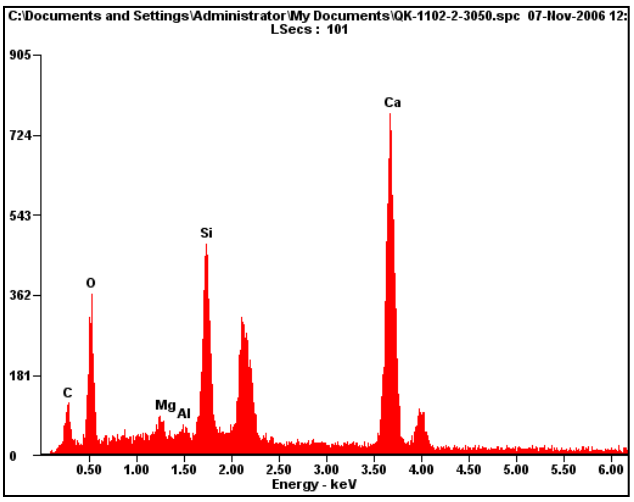


US Gypsum (Green label). 12,000X showing the crystal structure.

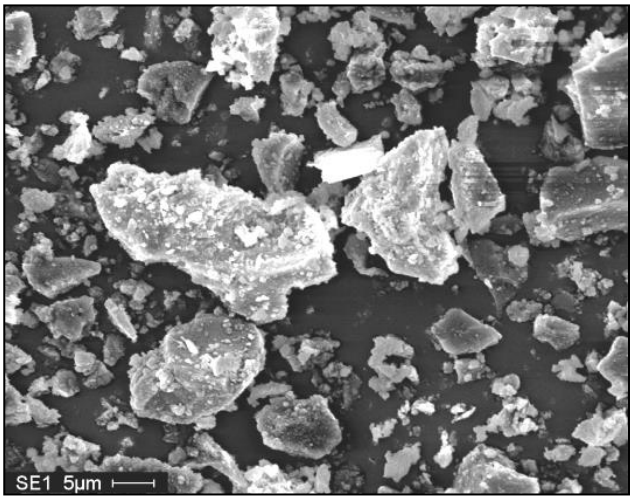
COMMON EXAMPLE PARTICLES

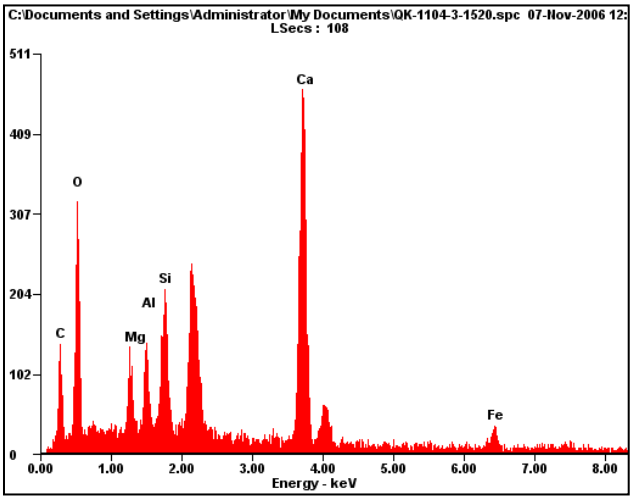
Example particles images & X-ray spectra – Different concrete mixes



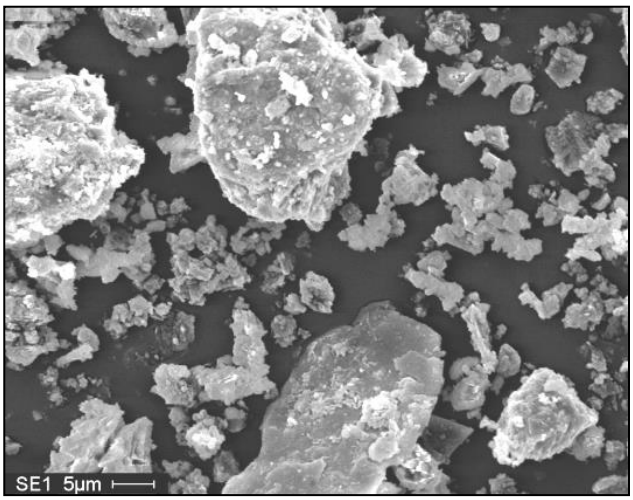


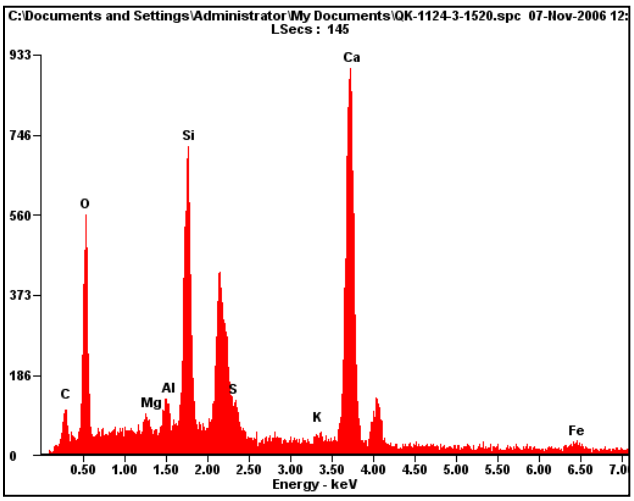
Quik krete 1102 – 3050x





Quik krete 1104 – 1520x

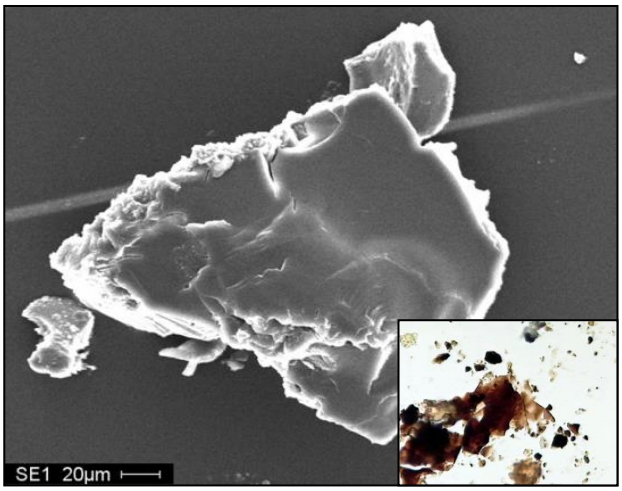


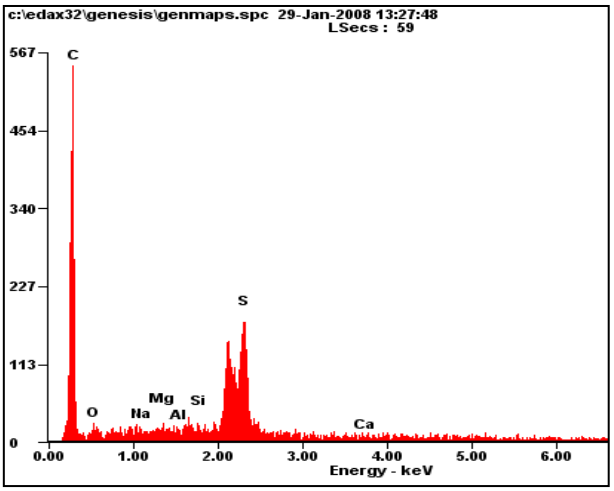


Quik krete 1124 – 1520x

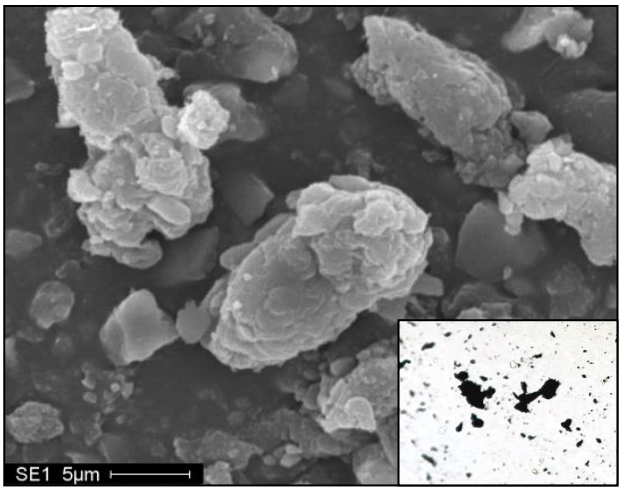
COMMON EXAMPLE PARTICLES

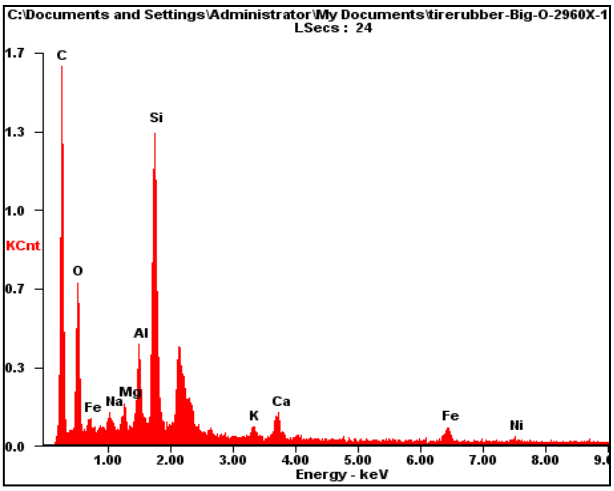
Example particles images & X-ray spectra – Carbonaceous road related





Road asphalt

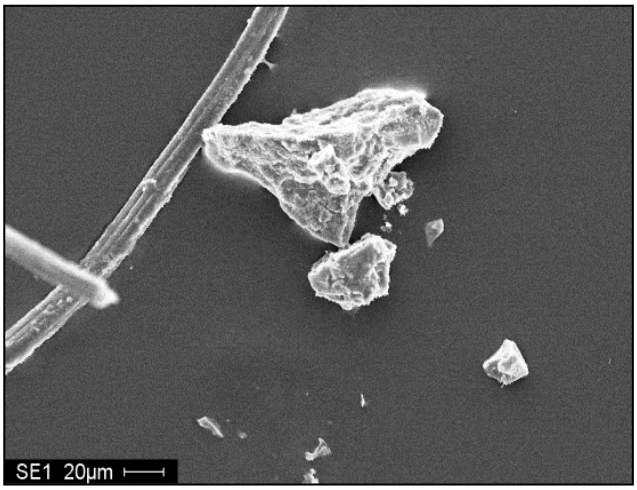


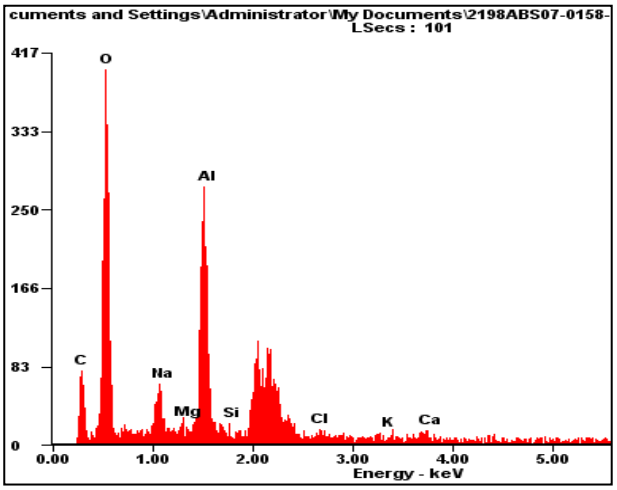


Tire rubber – Big-O tires – 3000x

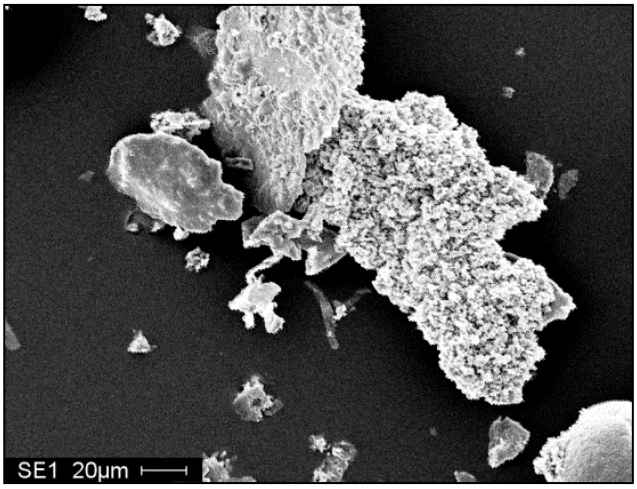
COMMON EXAMPLE PARTICLES

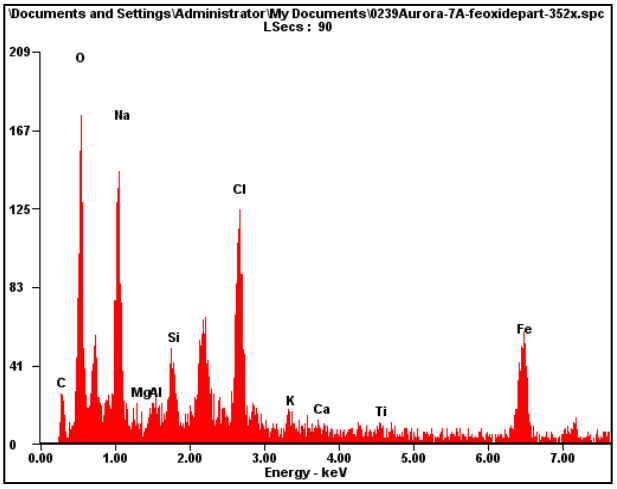
Example particles images & X-ray spectra – Corrosion particles



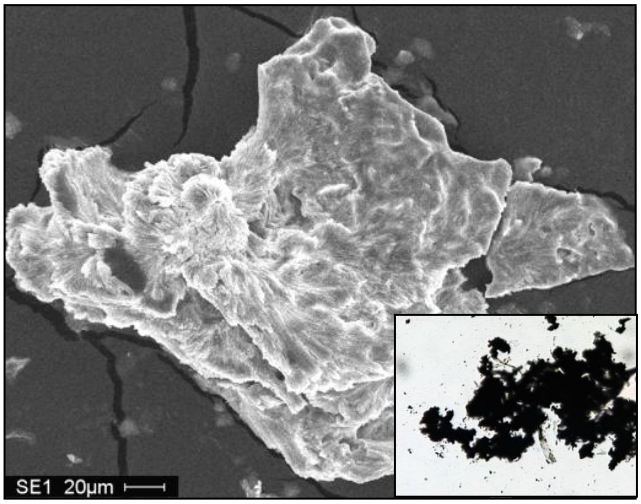


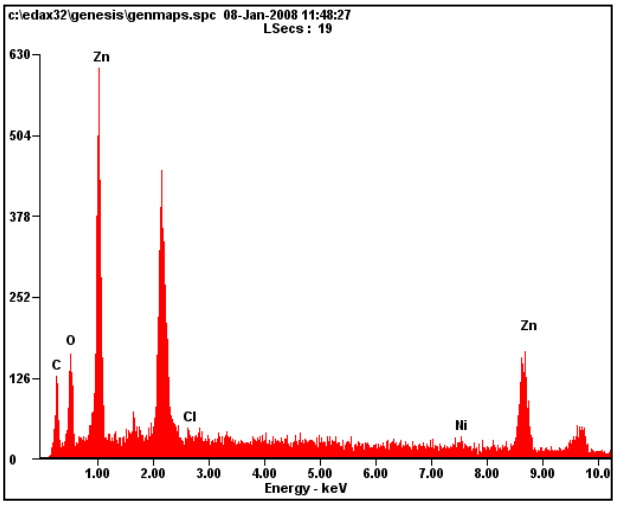
Aluminum HVAC system oxide





Iron oxide / chloride – Water corrosion

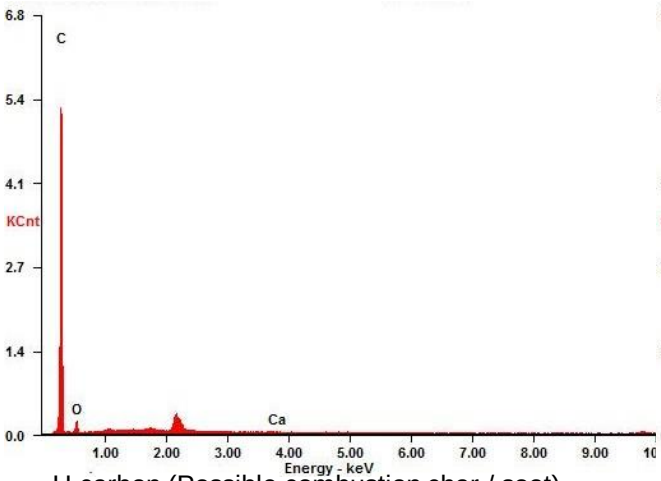




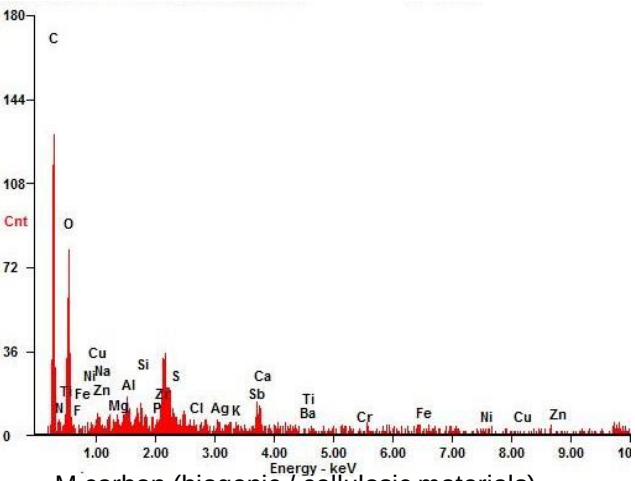
Zinc oxide – Galvanized ducting corrosion

EXAMPLE X-RAY Automated SEM PARTICLE CLASSIFICATIONS

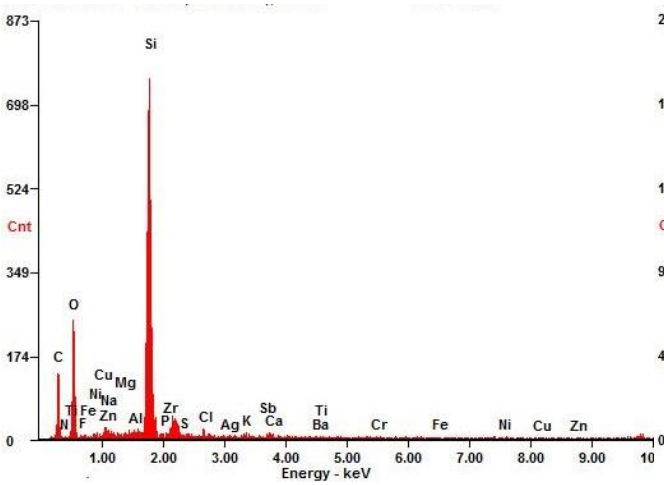
Common indoor / outdoor particle chemistry



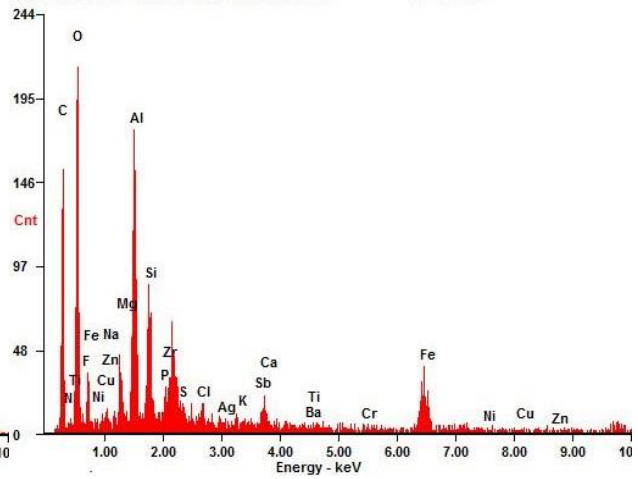
H carbon (Possible combustion char / soot)



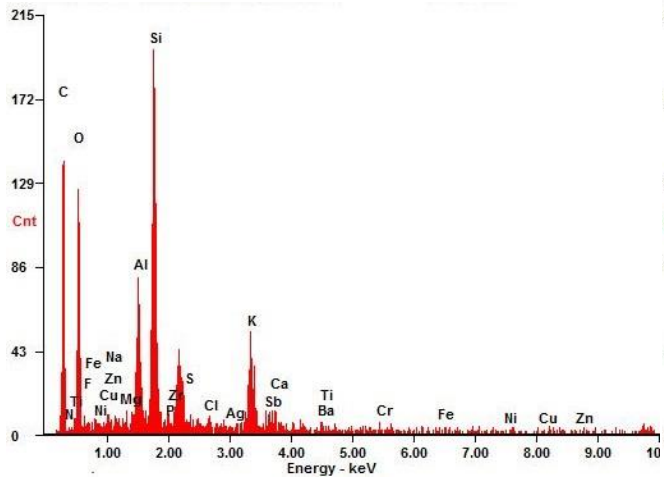
M carbon (biogenic / cellulosic materials)



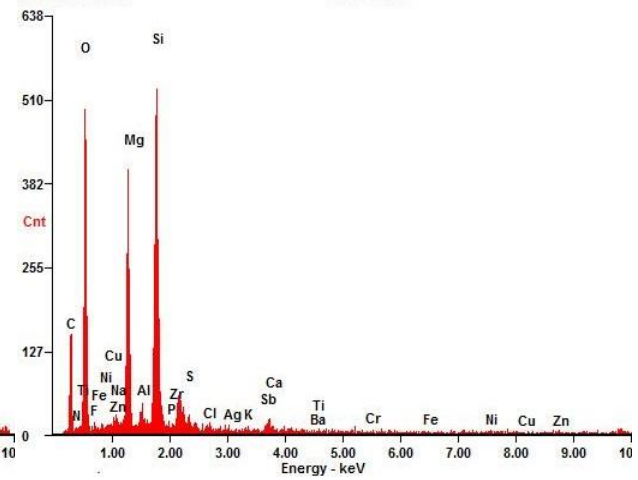
Quartz-like / Si oxide



M Al silicate



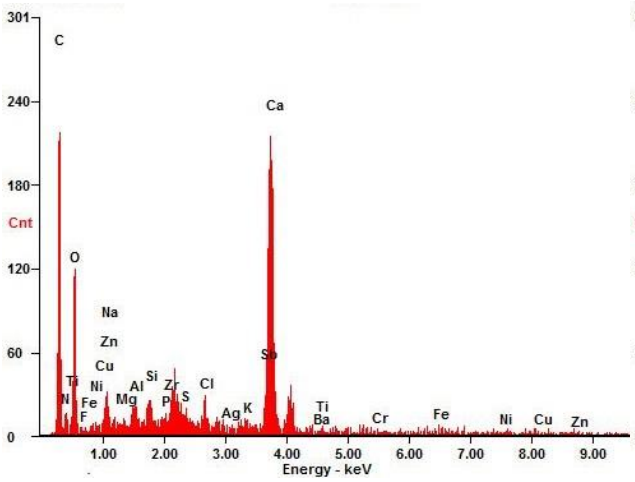
AlK silicate



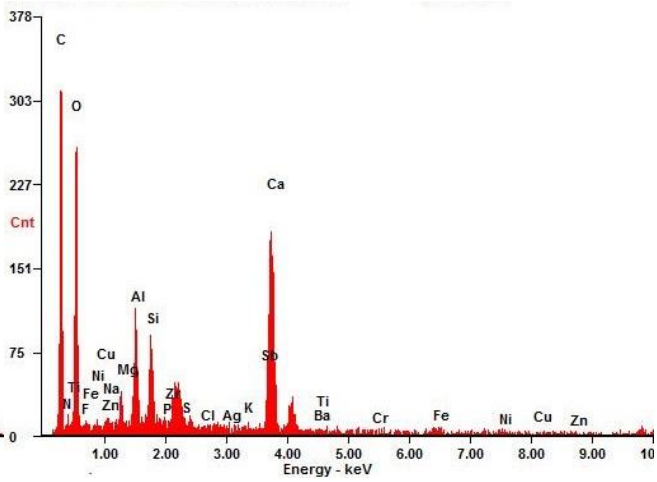
Mg silicate

EXAMPLE X-RAY Automated SEM PARTICLE CLASSIFICATIONS

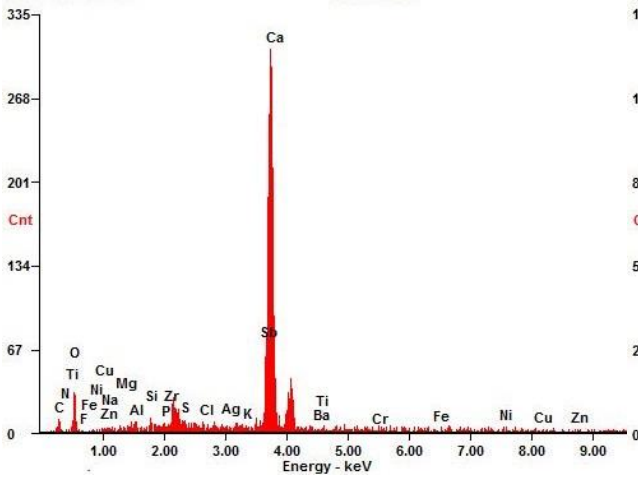
Common indoor / outdoor particle chemistry



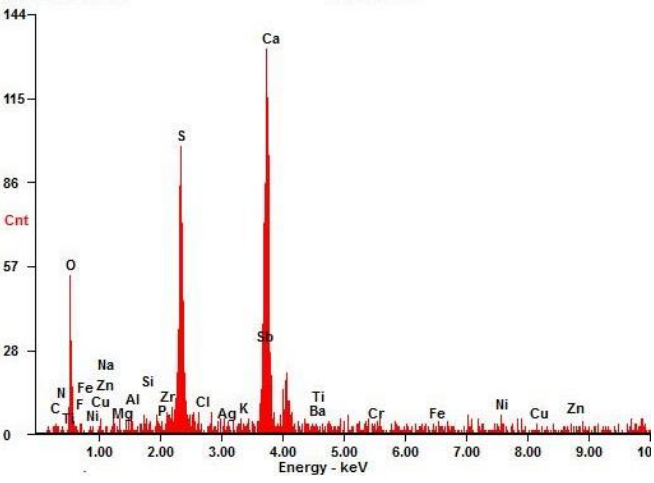
Ca carbonate



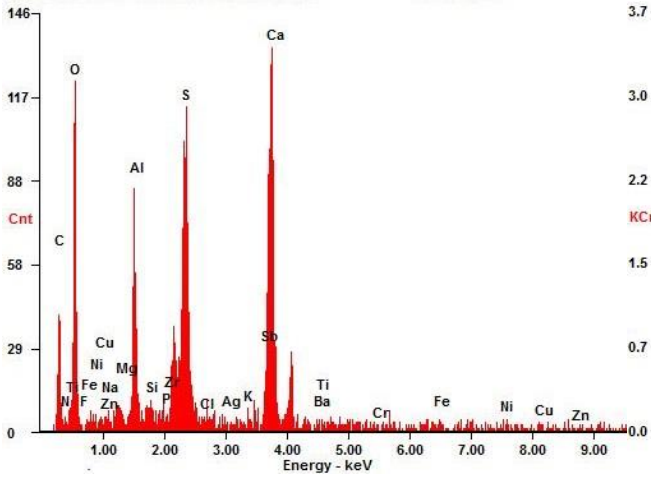
M Ca carbonate



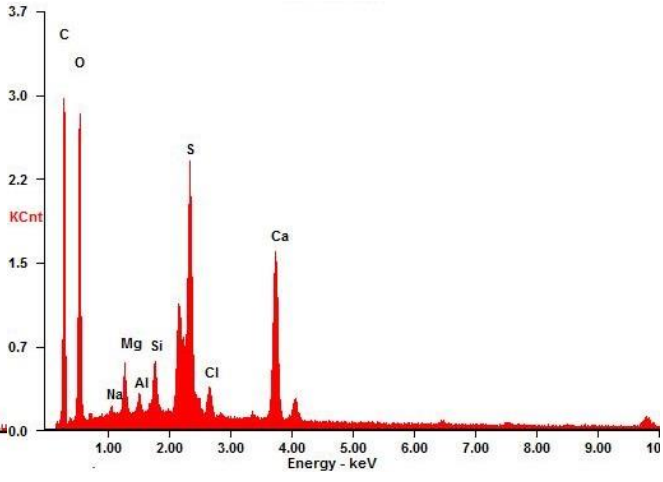
Ca oxide / Ca Oxalate



Ca sulfate



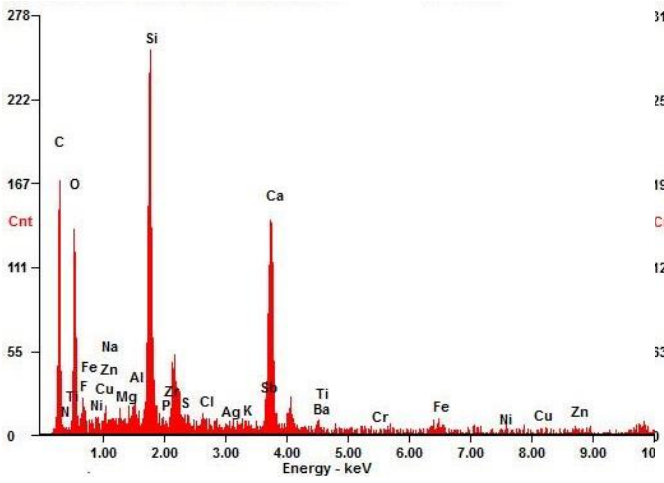
M Ca sulfate



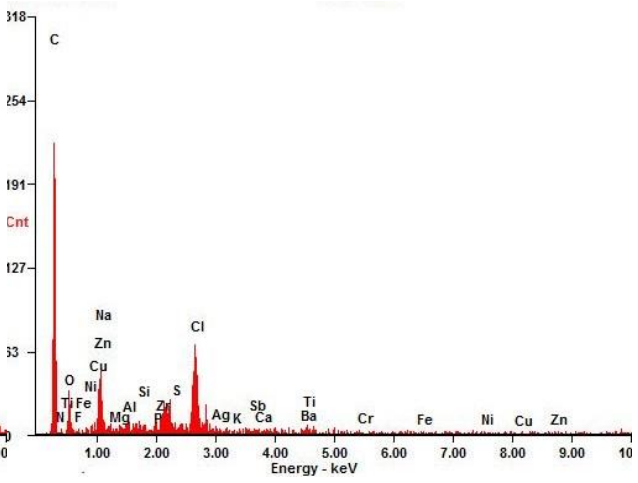
M Ca sulfate (Monokote fireproofing)

EXAMPLE X-RAY Automated SEM PARTICLE CLASSIFICATIONS

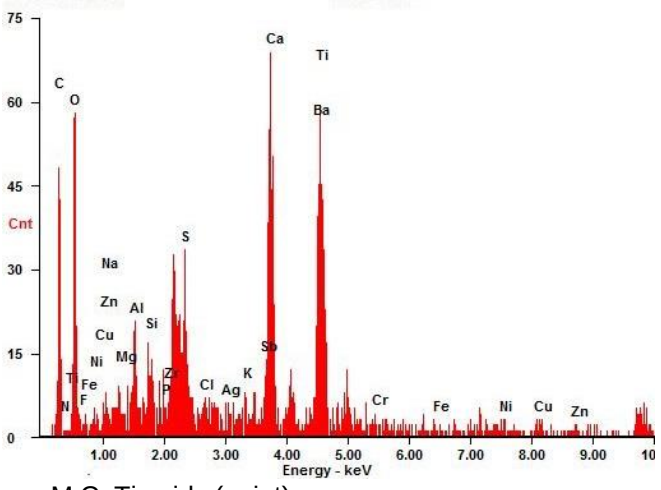
Common indoor / outdoor particle chemistry



Ca silicate



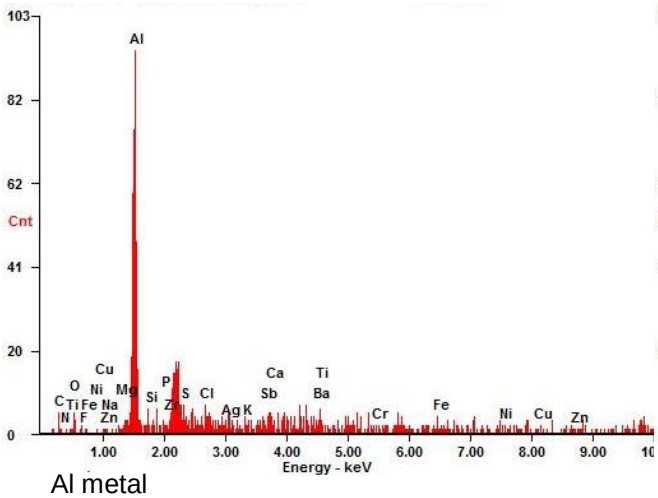
Na chloride (<10um particle)



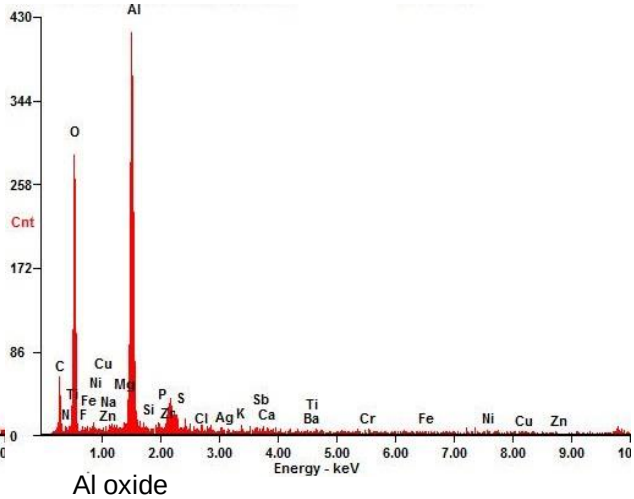
M CaTi oxide (paint)

EXAMPLE X-RAY Automated SEM PARTICLE CLASSIFICATIONS

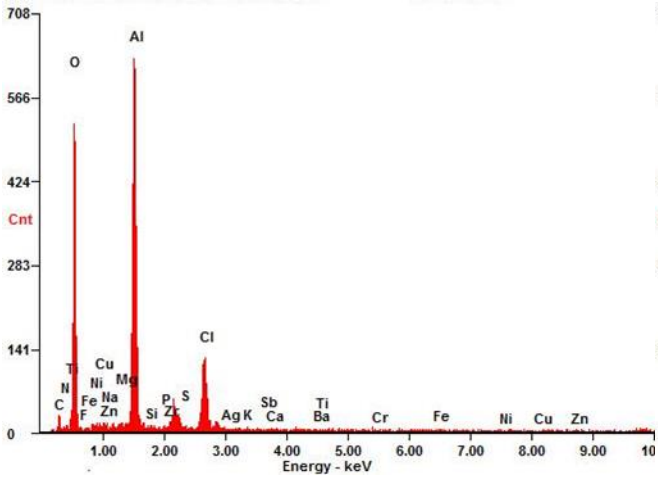
Common HVAC corrosion particle chemistry



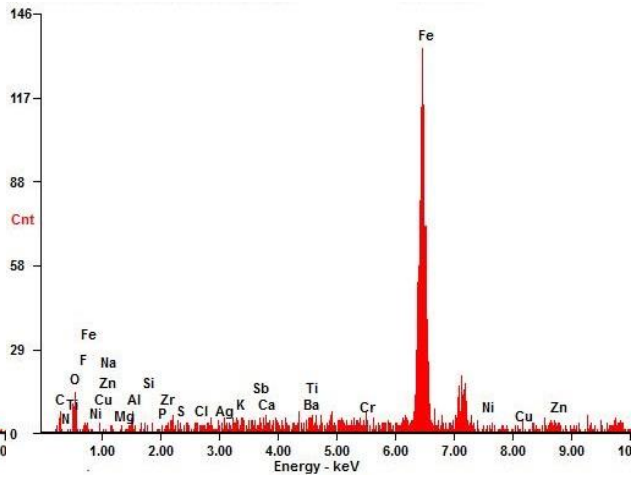
Al metal



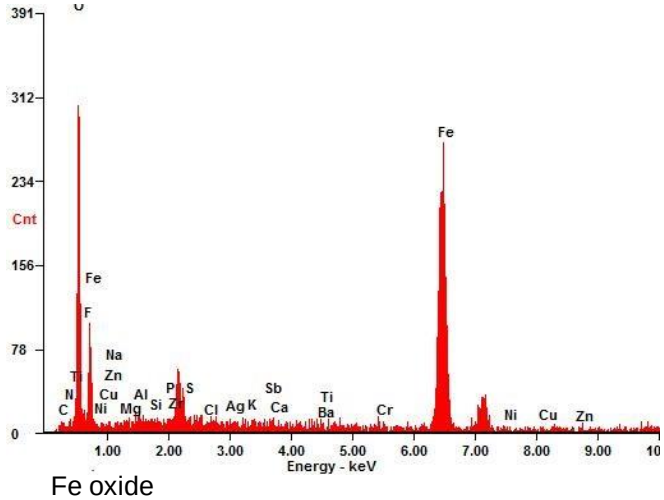
Al oxide



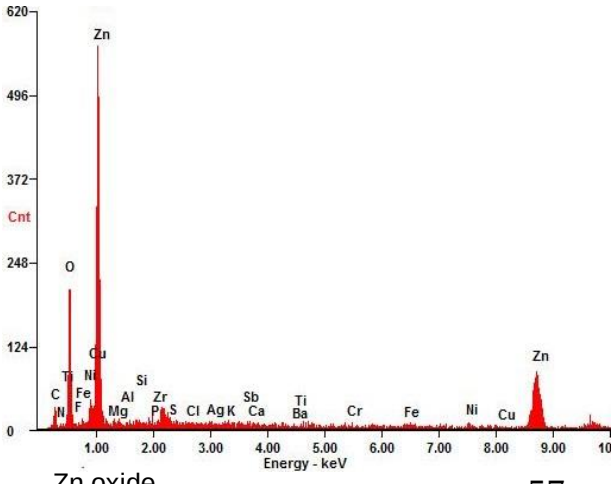
AlCl oxide (water corrosion)



Fe metal



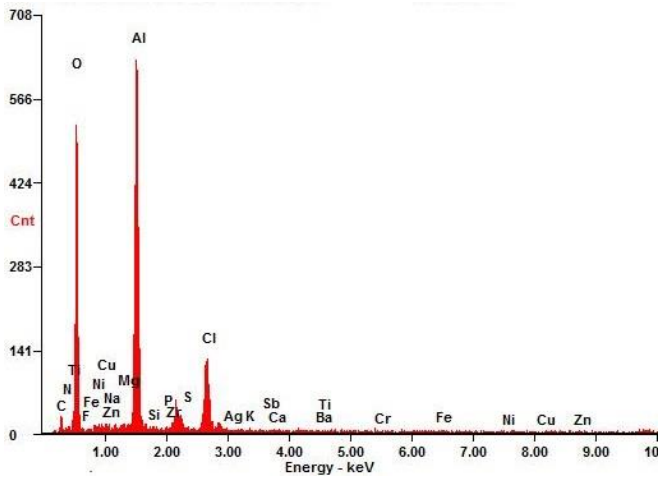
Fe oxide



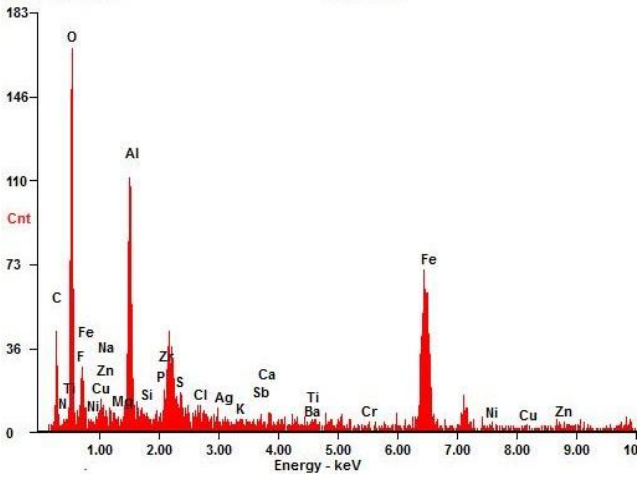
Zn oxide

EXAMPLE X-RAY Automated SEM PARTICLE CLASSIFICATIONS

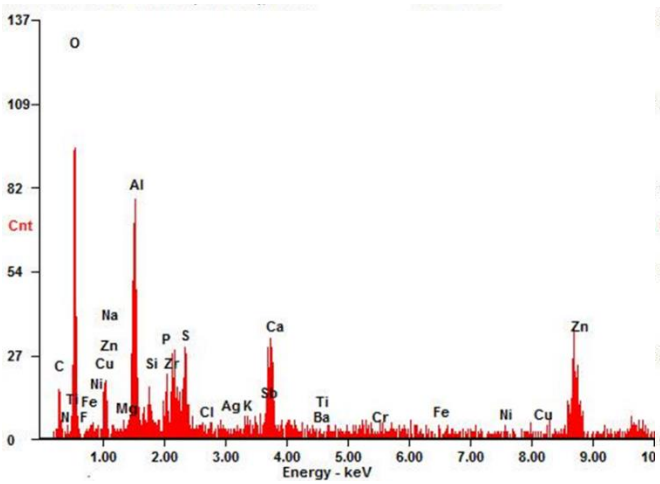
Common HVAC corrosion particle chemistry



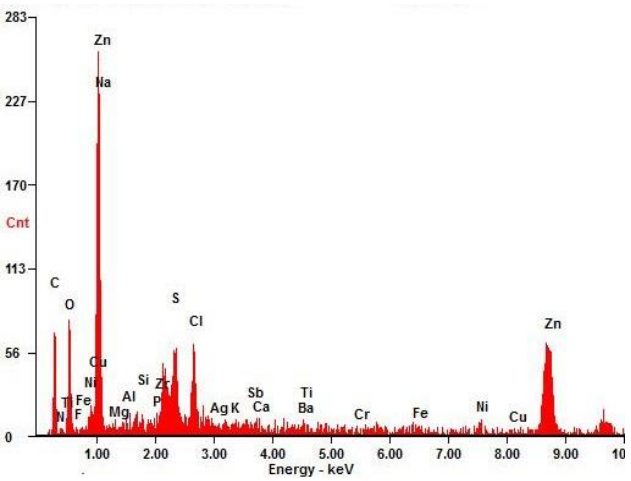
AlCl oxide (Water / electrolytic corrosion)



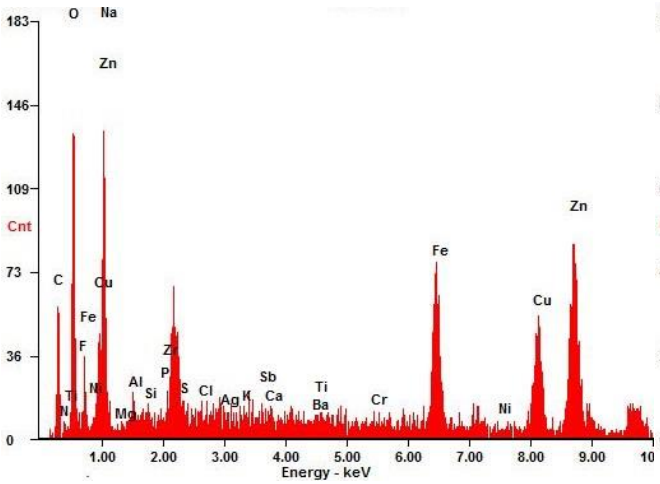
AlFe oxide



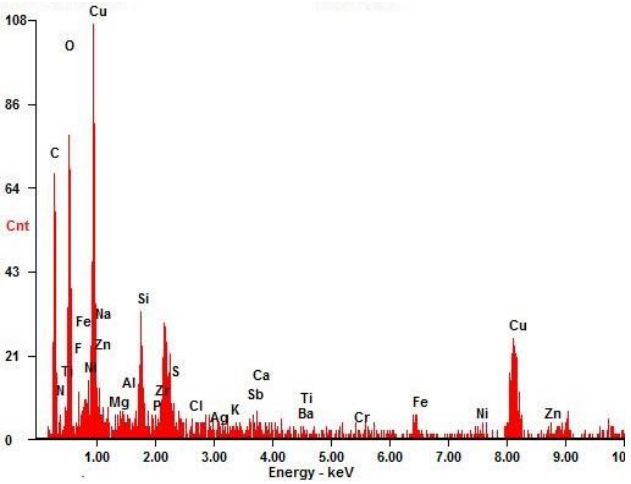
M AlZn oxide



M ZnCl oxide



FeCuZn oxide



M Cu oxide

AIR PROFILE ™

Michigan Environmental Laboratory ***(AIHA-LAP, LLC. accredited)***
306 5th Street, Suite 2A Bay City, MI 48708
Phone: 989-895-4447
Email: dbaxter@eaalab.com
Website: eaalab.com

California Forensic Materials Laboratory
5290 Soledad Road, San Diego, CA 92109
Phone: 858-272-7747
Email: dbaxter@eaalab.com
Website: eaalab.com