The excerpts on the following pages are from 3 different types of dust analysis reports generated by the new Automated SEM procedure developed by Environmental Analysis. This analysis capability is now located in both the Bay City Michigan, and San Diego California laboratory locations. The particle size/mass distribution, and chemistry of complex airborne and surface dust samples can be simultaneously quantified, and then “classified” into a profile of probable emission sources at an economical price ($250 - $350/sample).

**Example Applications:**
- Identification of IAQ dust contamination sources
- Wildfire and structure fire particle analysis
- Respirable quartz in airborne coal dust
- Inhalable / respirable particle size analysis
- Monitoring of hospital OR’s and clean rooms
- Product / dust comparison analysis

### Particle Classification Summary Table

<table>
<thead>
<tr>
<th>Particle Classification</th>
<th>Particles Counted</th>
<th>Mean size (um)</th>
<th>*Specific Gravity</th>
<th>Numerical %</th>
<th>*Mass Ratio %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca oxide</td>
<td>61</td>
<td>13.7</td>
<td>3.00</td>
<td>30.5%</td>
<td>60.9%</td>
</tr>
<tr>
<td>Ca carbonate</td>
<td>49</td>
<td>8.8</td>
<td>3.00</td>
<td>24.5%</td>
<td>16.0%</td>
</tr>
<tr>
<td>CaMgSiK carbonate</td>
<td>44</td>
<td>4.1</td>
<td>3.00</td>
<td>22.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>MgK carbonate</td>
<td>3</td>
<td>10.2</td>
<td>3.00</td>
<td>1.5%</td>
<td>1.3%</td>
</tr>
<tr>
<td>CaMgK phosphate</td>
<td>13</td>
<td>6.6</td>
<td>3.00</td>
<td>6.5%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Si carbon</td>
<td>3</td>
<td>5.0</td>
<td>1.50</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Quartz</td>
<td>3</td>
<td>5.7</td>
<td>2.60</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ca sulfate</td>
<td>3</td>
<td>3.8</td>
<td>3.00</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Mixed Ca silicate</td>
<td>1</td>
<td>16.2</td>
<td>3.00</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>MgKCaFe silicate</td>
<td>2</td>
<td>20.4</td>
<td>3.00</td>
<td>1.0%</td>
<td>12.8%</td>
</tr>
<tr>
<td>Unclassified</td>
<td>18</td>
<td>7.1</td>
<td>2.00</td>
<td>9.0%</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

**Wildfire Fire Ash – Particle Classification Summary Table**

<table>
<thead>
<tr>
<th>Particle Classification</th>
<th>Particles Counted</th>
<th>Mean size (um)</th>
<th>*Specific Gravity</th>
<th>Numerical %</th>
<th>*Mass Ratio %</th>
</tr>
</thead>
<tbody>
<tr>
<td>MgAlKCaFe silicate</td>
<td>2</td>
<td>20.4</td>
<td>3.00</td>
<td>1.0%</td>
<td>12.8%</td>
</tr>
<tr>
<td>Mixed Ca silicate</td>
<td>1</td>
<td>16.2</td>
<td>3.00</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Si carbon</td>
<td>3</td>
<td>5.0</td>
<td>1.50</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Quartz</td>
<td>3</td>
<td>5.7</td>
<td>2.60</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ca carbonate</td>
<td>1</td>
<td>3.8</td>
<td>3.00</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Ca sulfate</td>
<td>1</td>
<td>3.8</td>
<td>3.00</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Unassigned</td>
<td>1</td>
<td>3.8</td>
<td>3.00</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

For more information contact Daniel Baxter at Environmental Analysis Associates, Inc.

San Diego, California
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San Diego, CA 92109

Bay City, Michigan
306 5th Street, Suite 400
Bay City, MI 48708

Phone:  858-272-7747
Email:  dbaxter@eaalab.com
Website: eaalab.com
Automated Scanning Electron Microscopy - Dust Analysis Photo Report

Client Name: Research
Contact: Daniel Baxter
Client Project #: Fire pit ash 4-14-15
Client Sample #: 041015-1
Sample Description: Oak fire ash sample from Michigan fire pit
Analysis Method: Automated SEM/EDS

Analysis Date: 8/14/15
EAA Project #: Fire pit
EAA Sample #: Fire ash-1

204x - Secondary electron image of analyzed field
204x - Backscatter image of analyzed field

Calcium "oxide" crystals - 490x
Calcium "oxide" crystals - 2010x
SUMMARY CONCLUSIONS

The fire ash was fully "decarbonized" at high temperature and is primarily composed of Calcium oxide / hydroxide, and Calcium carbonate and Magnesium, Potassium (K) salts. Minor amounts of Calcium/Magnesium silicates and phosphorus (P) oxides are also present. The Calcium oxide / oxalate crystals are the most common indicator particles for wood "ash".

<table>
<thead>
<tr>
<th>Particle Classification</th>
<th>Particles Counted</th>
<th>Mean size (um)</th>
<th>Specific Gravity</th>
<th>Numerical %</th>
<th>* Mass Ratio %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon H</td>
<td>1</td>
<td>8.3</td>
<td>1.50</td>
<td>0.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>M carbon</td>
<td>9</td>
<td>4.0</td>
<td>1.50</td>
<td>4.5%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Ca oxide</td>
<td>61</td>
<td>13.7</td>
<td>2.00</td>
<td>30.5%</td>
<td>59.7%</td>
</tr>
<tr>
<td>Ca carbonate</td>
<td>53</td>
<td>8.2</td>
<td>2.00</td>
<td>26.5%</td>
<td>16.6%</td>
</tr>
<tr>
<td>CaMgSiK carbonate</td>
<td>46</td>
<td>4.2</td>
<td>2.00</td>
<td>23.0%</td>
<td>1.4%</td>
</tr>
<tr>
<td>MgK carbonate</td>
<td>3</td>
<td>10.2</td>
<td>2.00</td>
<td>1.5%</td>
<td>1.2%</td>
</tr>
<tr>
<td>CaMgK phosphate</td>
<td>13</td>
<td>6.6</td>
<td>2.00</td>
<td>6.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Quartz</td>
<td>4</td>
<td>7.9</td>
<td>2.00</td>
<td>2.0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Ca sulfate</td>
<td>3</td>
<td>3.8</td>
<td>2.00</td>
<td>1.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Mixed Ca silicate</td>
<td>1</td>
<td>16.2</td>
<td>2.00</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>MgAlKCaFe silicate</td>
<td>2</td>
<td>20.4</td>
<td>2.00</td>
<td>1.0%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Unclassified</td>
<td>4</td>
<td>10.8</td>
<td>2.00</td>
<td>2.0%</td>
<td>3.8%</td>
</tr>
</tbody>
</table>

*Mass ratios are based on the average particle size & theoretical specific gravity. If the specific gravity is unknown and not "carbonaceous", it will automatically be assigned a density value of 2.0

"Unclassified" particles fall outside of the established chi square rule fit criteria.

Client Name: Research
Contact: Daniel Baxter
Client Project #: Fire pit ash 4-14-15
Client Sample #: 041015-1
Sample Description: Oak fire ash sample from Michigan fire pit
Analysis Method: Automated SEM/EDS

Analysis Date: 8/14/15
EAA Project #: Fire pit
EAA Sample #: Fire ash-1

Estimated Mass %

- MgAIKCaFe silicate, 12.5%
- Unclassified, 3.8%
- Carbon H, 0.1%
- M carbon, 0.2%
- Ca oxide, 59.7%
- CaMgSiK carbonate, 1.4%
- CaMgK phosphate, 2.5%
- MgK carbonate, 1.2%
- Quartz, 0.8%
- Ca carbonate, 16.6%
- Ca sulfate, 0.1%
- Mixed Ca silicate, 1.0%

INDIVIDUAL NUMERICAL SIZE PERCENT (Greater than stated size)

- Unclassified
- MgAIKCaFe silicate
- Mixed Ca silicate
- Ca sulfate
- Quartz
- CaMgK phosphate
- MgK carbonate
- CaMgSiK carbonate
- Ca carbonate
- Ca oxide
- M carbon
- Carbon H

Graph showing estimated mass percentage for various compounds and individual numerical size percent (greater than stated size).
Client Name: ABC Environmental
Contact: Mr. John Doe
Client Project #: 14-1000
Client Sample #: 110314-1
Sample Description: "Trace" white powder in HVAC system duct
Analysis Method: Automated SEM/EDS

Field 1 107x - Flake-like corrosion particles
Automated Scanning Electron Microscopy - Dust Analysis Report

Summary Page

Client Name: ABC Environmental
Analysis Date: 8/14/15

Contact: Mr. John Doe
EAA Project #: 14-0495

Client Project#: 14-1000
EAA Sample #: 1000-1

Client Sample #: 110314-1

Sample Description: “Trace” white powder in HVAC system duct
Fields Counted: 1

Analysis Method: Automated SEM/EDS
Field area cted (mm$^2$): 0.127

Analysis Magnification: 107
Particles / mm$^2$: 315

Min. size threshold (um): 3.0
Scale (µm/div.): 1

Max. size threshold (um): 1000
Total particles counted: 40

SUMMARY CONCLUSIONS

Sample is composed of a mixture of aluminum oxide and mixed aluminum, iron, and zinc corrosion oxide particles. These particles also contain low concentrations of chlorine / chlorides.

The dust is consistent with corrosion of the ducting and "galvanized" duct coatings.

Carbon H = Particle with greater than 60% carbon

<table>
<thead>
<tr>
<th>Particle Classification</th>
<th>Particles Counted</th>
<th>Mean size (um)</th>
<th>Specific Gravity</th>
<th>Numerical %</th>
<th>Mass Ratio %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon H</td>
<td>3</td>
<td>58.4</td>
<td>1.00</td>
<td>7.5%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Al oxide</td>
<td>27</td>
<td>49.0</td>
<td>1.00</td>
<td>67.5%</td>
<td>61.1%</td>
</tr>
<tr>
<td>Zn oxide</td>
<td>2</td>
<td>50.9</td>
<td>1.00</td>
<td>5.0%</td>
<td>2.1%</td>
</tr>
<tr>
<td>M AlFeZn oxide</td>
<td>8</td>
<td>42.5</td>
<td>2.00</td>
<td>20.0%</td>
<td>33.9%</td>
</tr>
<tr>
<td>Unclassified</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Mass ratios are based on the average particle size & theoretical specific gravity. If the specific gravity is unknown and not "carbonaceous", it will automatically be assigned a density value of 2.0

*Unclassified* particles fall outside of the established chi square rule fit criteria

Analysis Method: Automated EDAX Genesis X-ray particle analysis software integrated with a
data libraries developed by Environmental Analysis

Analyst: Daniel M. Bather
Date: 8/14/15
Client Name: ABC Environmental
Contact: Mr. John Doe
Client Project #: 14-1000
Client Sample #: 110314-1
Sample Description: "Trace" white powder in HVAC system duct
Analysis Method: Automated SEM/EDS

Analysis Date: 8/14/15
EAA Project #: 14-0495
EAA Sample #: 1000-1

Estimated Mass %

- Unclassified, 0.0%
- Carbon H, 2.9%
- M AlFeZn oxide, 33.9%
- Zn oxide, 2.1%
- Al oxide, 61.1%

INDIVIDUAL NUMERICAL SIZE PERCENT
(Greater than stated size)
Automated Scanning Electron Microscopy - Dust Analysis Photo Report

Client Name: Research
Contact: Dan Baxter
Client Project #: Mining rock
Client Sample #: Coal mine-1
Sample Description: Air sample - During operations
Analysis Method: Simulated 25mm PC filter analysis

Coal mine-1
Field 1
Magnification (X) 497

Coal mine-1
Field 2
Magnification (X) 497
Scanning Electron Microscopy Air Sample - Summary Report

Filter / Impaction Air Sample

Client Name : Research
Contact : Dan Baxter
Client Project # : Mining rock
Client Sample # : Coal mine-1

Sample Description : Air sample - During operations
Fields / passes counted : 2
Field area counted (mm$^2$) : 0.069

Filter collection diameter

Analysis Magnification : 497
Scale (µm/div.) : 1
Total particles counted : 342
Sample volume (m$^3$) : 2.400
Min./Max. size range (um) : 3 / 165

% of sample counted : 0.02%

Analysis Date : 7/22/15
EAA Project # : Research
EAA Sample # : 1000-1

Summary Conclusions - Major Constituents

Simulated air sample output using the bulk analysis of the Rom rock.
Sample is primarily highly carbonaceous (Carbon H >30%), mixed Alumino-silicate minerals (Al silicate >50%), Quartz (~2%). Minor amounts of Calcium carbonate (Ca carbonate) and Magnesium Calcium Carbonate (MgCa carbonate) present.

Minor Constituents:

<table>
<thead>
<tr>
<th>Particle Classification</th>
<th># Cted</th>
<th>Mean (um)</th>
<th>Num. %</th>
<th>Mass %</th>
<th>Spec Grav</th>
<th>Part. / Sample</th>
<th>Part / m$^3$</th>
<th>Mass ug/m$^3$</th>
<th>Mass ug/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon H</td>
<td>91</td>
<td>8.5</td>
<td>26.6%</td>
<td>22.6%</td>
<td>1.50</td>
<td>526015</td>
<td>219173</td>
<td>444.7</td>
<td>105.6</td>
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<td>AlSi carbon</td>
<td>29</td>
<td>11.1</td>
<td>8.5%</td>
<td>19.1%</td>
<td>1.50</td>
<td>167631</td>
<td>69846</td>
<td>376.8</td>
<td>74.1</td>
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<tr>
<td>Ca carbonate</td>
<td>2</td>
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<td>0.9%</td>
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<td>11561</td>
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<tr>
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<td>612721</td>
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<td>AlK silicate</td>
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<td>9.9%</td>
<td>6.6%</td>
<td>2.00</td>
<td>196533</td>
<td>81889</td>
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<td>58.8</td>
</tr>
<tr>
<td>M silicate</td>
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<td>15.9%</td>
<td>2.00</td>
<td>242776</td>
<td>101157</td>
<td>313.9</td>
<td>118.6</td>
</tr>
<tr>
<td>Quartz</td>
<td>29</td>
<td>5.8</td>
<td>8.5%</td>
<td>1.9%</td>
<td>2.60</td>
<td>167631</td>
<td>69846</td>
<td>37.8</td>
<td>19.0</td>
</tr>
<tr>
<td>Unclassified</td>
<td>8</td>
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<td>2.3%</td>
<td>3.4%</td>
<td>2.00</td>
<td>46243</td>
<td>19268</td>
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<td>50.8</td>
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<tr>
<td>TOTALS</td>
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<td>2.00</td>
<td>46243</td>
<td>19268</td>
<td>66.8</td>
<td>50.8</td>
</tr>
</tbody>
</table>

* The calculated mass/m$^3$ is based on the sum total of each particle volume & theoretical specific gravity.
The ** Mean Mass is calculated using the Mean particle size for each category. Both calculations should be used as the likely range of estimated particle mass concentrations.

Analysis Method : Automated EDAX Genesis X-ray particle analysis
Analyst : Daniel M. Baxter
Date : 7/22/15

Client Name: Research
Contact: Dan Baxter
Client Project #: Mining rock
Client Sample #: Coal mine-1
Sample Description: Air sample - During operations
Analysis Method: Simulated 25mm PC filter analysis

Analysis Date: 7/22/15
EAA Project #: Research
EAA Sample #: 1000-1

Estimated Mass %

- Unclassified, 3.4%
- Quartz, 1.9%
- M silicate, 15.9%
- AlK silicate, 6.6%
- Al silicate, 29.6%
- AlSi carbon, 19.1%
- Ca carbonate, 0.9%
- MgCa carbonate, 0.0%
- Carbon H, 22.6%

INDIVIDUAL NUMERICAL SIZE PERCENT
(Greater than stated size)