June 8, 2015

Clemson University
310 Klugh Avenue
Clemson, SC 29634

Attn: Mr. W. Robert Newberry, IV
E: wnewber@clemson.edu

Re: Unknown Particulate Sampling
Clemson University
P&A Building
Clemson, South Carolina
Terracon Project No. 86127158

Dear Mr. Newberry:

Terracon Consultants, Inc. (Terracon) conducted sampling of an unknown particulate that was reported by staff in the basement level of the P&A Building located on Clemson University's main campus in Clemson, South Carolina. Terracon was requested to sample and help identify the material, based on complaints from staff members in the building. The sampling was performed in general accordance with our IDC with Clemson University.

PROJECT DESCRIPTION

At the request of Clemson University Terracon conducted a sampling of an unknown particulate within the P&A building. It is our understanding there are occupant complaints pertaining to deposits of this particulate on surfaces within several rooms which are used for scientific research for the school of animal and veterinary science. This investigation was conducted at the subject site on May 7, 2015 based on information provided to Terracon relating to building conditions and/or occupant complaint(s).

This investigation was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. Terracon did not attempt to identify every potential exposure or hazard present in the subject building. The results, findings, conclusions, and recommendations expressed in this report are based on conditions observed during our investigation. Many factors, such as weather conditions, building occupancy, ventilation patterns, and local sources of volatile chemicals, can affect the conditions observed. The information contained in this report should not be relied upon to represent conditions that existed prior to or after this investigation. Terracon does not warrant the services of regulatory agencies, laboratories, or other third parties supplying information that may have been used in the preparation of this report.

INVESTIGATION CRITERIA AND METHODS

Surficial wipe samples were collected from horizontal surfaces in three laboratories located in the basement level of the building. Sample media consisted of sterile cotton gauze soaked in alcohol. Based on guidance from staff member Marcy Dimmick, samples were collected from labs C-122, B110b and B108A within the basement level of the P&A Building. Complaints originated from Ms. Dimmick and her co-worker, Nancy Korn.

After wipe sample collection, the samples were shipped under to EMSL Analytical, Inc. (EMSL) in Cinnaminson, New Jersey. The samples were visually analyzed for Common Particle ID using polarized light microscopy, epi-Reflected Light Microscopy and Stereo Microscopy.

FINDINGS

Results of the visual analysis were qualitative in nature and descriptions of the materials from the samples collected in C-122 and B108A were similar. The principle materials identified were unidentified organics and rubber dust. Other minor materials observed were mold, pollen, skin fragments, fibrous glass and synthetic fabrics.

The result from the sample collected in B110b was described as unidentified organics, clay/feldspars and iron oxide (rust).

Additional analysis by scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM/EDX) and/or fourier transform infrared spectroscopy (FTIR) was recommended to better identify these particulates.

CONCLUSIONS AND RECOMMENDATIONS

Based on the analytical results from the air sampling and the location of the particulate on the supply side registers of the HVAC system, it is likely that an insulation product located inside the HVAC system is deteriorating and being distributed into the labs investigated. As the building has multiple air handling units, a re-inspection of the air handler(s) that supply these three labs is required to identify the source of the particulate. Guidance from the facility managers assigned to the P&A building on which air handlers supply labs C-122, B110B and B108A could expedite this HVAC inspection.

Terracon appreciates the opportunity to provide this service to Clemson University. If you have any questions regarding this limited asbestos sampling report, please contact the undersigned at 864-292-2901.

Sincerely,
Terracon Consultants, Inc.



Benjamin Hestir, P.E.
Project Industrial Hygienist



Scott Rohlf CIH
Authorized Project Reviewer

Attachments: Laboratory Results
Site Photos

Laboratory Results

EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077
Phone: (856) 858-4800

Attn.: *Ben Hestir*
Terracon Consultants, Inc.
3534 Rutherford Road
Taylors, SC 29687

Phone: 864-275-9962

EMSL Order ID: 361500937
Sample(s) Received: 5/11/2015
Date of Reporting: 5/18/2015
Date Printed: 5/18/2015
Reported By: T. Sanders
Email: Ben.hestir@terracon.com

- Laboratory Report -

Common Particle Identification

Project: Not Specified

Conclusions:

- Sample "C122-1" is composed primarily of material that cannot be confirmatory identified by the methods used in this analysis (it appears to be composed primarily of unidentified organic material and rubber dust; additional analysis by SEM/EDX and/or FTIR is needed to confirm the identity of these particles), quartz, calcite/dolomite and processed cellulose. Mold, pollen, skin fragments, fibrous glass, natural cellulose, starch and synthetic fibers were identified as minor components.
- Sample "B110b-1" is composed primarily of material that cannot be confirmatory identified by the methods used in this analysis (it appears to be composed primarily of unidentified organic material, clay/feldspars and rust (iron oxides); additional analysis by SEM/EDX and/or FTIR is needed to confirm the identity of these particles), quartz, calcite/dolomite and processed cellulose. Mold, skin fragments, fibrous glass, wood, starch and synthetic fibers were identified as minor components.
- Sample "B108A-1" is composed primarily of material that cannot be confirmatory identified by the methods used in this analysis (it appears to be composed primarily of unidentified organic material and rubber dust; additional analysis by SEM/EDX and/or FTIR is needed to confirm the identity of these particles), quartz, calcite/dolomite and processed cellulose. Mold, pollen, skin fragments, fibrous glass and synthetic fibers were identified as minor components.

Procurement of Samples and Analytical Overview:

The material for analysis (three bulk samples) arrived at EMSL Analytical (Cinnaminson, NJ) on May 11, 2015. The package arrived in satisfactory condition with no evidence of damage to the contents. The purpose of the analysis is to determine the identification of the individual components. The data reported herein has been obtained using the following equipment and methodologies.

Methods & Equipment: Polarized Light Microscopy (PLM)
epi-Reflected Light Microscopy (RLM)
Stereo Microscopy

Analyzed by: *Toni Sanders*, *Materials Analyst* — May 18, 2015 (*Date*)

Reviewed/Approved: *Eugenia Mirica, Ph.D.*, *Laboratory Manager* — May 18, 2015 (*Date*)

EMSL Analytical, Inc.

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Results:

EMSL Sample Identification:	361500937-0001
Sample Identification:	C122-1
Sample Description:	Room C122- top of BBP container

Common Minerals/Construction Dust:	**(%)**	**Fibrous Particulate:**		**(%)**
Quartz	5	Asbestos:	(Total)	ND
Calcite/Dolomite	5	MMVF's:	Fibrous Glass/RCF's	<1
			Mineral Wool	ND
Biological:	**(%)**	Cellulosic (A):	Processed/Cotton	20
Mold	<1		Natural	<1
Pollen	<1		Wood	ND
Diatoms	ND		Paper Pulp	ND
Insect Fragments	ND		Starch	<1
Dust Mites	ND	Synthetic:	(Total)	2
Skin Fragments	<1	Hair:	Human	ND
			Animal	ND
Additional Particulate:	**(%)**			**(%)**
None	N/A	**Unidentified:**	Opaque Particles (B):	10
			Other (C):	52

A: Cellulose is a complex carbohydrate found in nature that is composed of glucose units; it forms the main constituent of the cell wall in most plants. Wood, paper, and cotton all contain cellulose fibers. The cellulose fibers used in clothing items undergo chemical processing that changes the character of the fibers in order to modify water and/or dyes retention.

B: The opaque/dark particles appear to be composed primarily of unidentified organic material and rubber dust. Additional analysis by SEM/EDX and/or FTIR is needed to confirm their identity.

C: The other unidentified material appears to be composed primarily of unidentified organic material. Additional analysis by SEM/EDX and possibly FTIR is required for confirmation.

Quartz: Crystalline form of silicon dioxide/silica (SiO_2), the second most common mineral in Earth's crust; commonly found in sand/soils, various rocks, concrete, and mortar.

Feldspars: Aluminum silicates containing varying amounts of calcium, potassium, or sodium, the most common minerals in Earth's crust; used as fluxing agents in ceramics and glass production, as fillers in paints, plastics, rubber adhesives, paper.

Clays: Clays are a large group of hydrous silicates composed mainly of silica, alumina, and water with varying amount of iron, alkaline, and alkaline earth elements; used commonly in construction materials, manufacturing of paper, refractories, rubber, dinnerware and pottery, floor and wall tile, sanitary wear, absorbent and filtering materials, and cosmetics.

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Email: Ben.hestir@terracon.com

EMSL Sample Identification: 361500937-0002
Sample Identification: B110b-1
Sample Description: Room B110b-from bookshelf

Common Minerals/Construction Dust:	**(%)**	**Fibrous Particulate:**		**(%)**
Quartz	5	Asbestos:	(Total)	ND
Calcite/Dolomite	10	MMVF's:	Fibrous Glass/RCF's	<1
			Mineral Wool	ND
Biological:	**(%)**	Cellulosic (A):	Processed/Cotton	15
Mold	<1		Natural	ND
Pollen	ND		Wood	<1
Diatoms	ND		Paper Pulp	ND
Insect Fragments	ND		Starch	<1
Dust Mites	ND	Synthetic:	(Total)	1
Skin Fragments	<1	Hair:	Human	ND
			Animal	ND
Additional Particulate:	**(%)**			**(%)**
None	N/A	**Unidentified:**	Opaque Particles (B):	10
			Other (C):	54

A: Cellulose is a complex carbohydrate found in nature that is composed of glucose units; it forms the main constituent of the cell wall in most plants. Wood, paper, and cotton all contain cellulose fibers. The cellulose fibers used in clothing items undergo chemical processing that changes the character of the fibers in order to modify water and/or dyes retention.

B: The opaque/dark particles appear to be composed primarily of unidentified organic material and clay/feldspars. Additional analysis by SEM/EDX and/or FTIR is needed to confirm their identity.

C: The other unidentified material appears to be composed primarily of unidentified material, clay/feldspars and rust (iron oxides). Additional analysis by SEM/EDX and possibly FTIR is required for confirmation.

Quartz: Crystalline form of silicon dioxide/silica (SiO_2), the second most common mineral in Earth's crust; commonly found in sand/soils, various rocks, concrete, and mortar.

Feldspars: Aluminum silicates containing varying amounts of calcium, potassium, or sodium, the most common minerals in Earth's crust; used as fluxing agents in ceramics and glass production, as fillers in paints, plastics, rubber adhesives, paper.

Clays: Clays are a large group of hydrous silicates composed mainly of silica, alumina, and water with varying amount of iron, alkaline, and alkaline earth elements; used commonly in construction materials, manufacturing of paper, refractories, rubber, dinnerware and pottery, floor and wall tile, sanitary wear, absorbent and filtering materials, and cosmetics.

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Reported By: T. Sanders
Email: Ben.hestir@terracon.com

EMSL Sample Identification:	361500937-0003
Sample Identification:	B108A-1
Sample Description:	Room B108A-from behind microscope

Common Minerals/Construction Dust:	**(%)**	**Fibrous Particulate:**		**(%)**
Quartz	5	Asbestos:	(Total)	ND
Calcite/Dolomite	5	MMVF's:	Fibrous Glass/RCF's	<1
			Mineral Wool	ND
Biological:	**(%)**	Cellulosic (A):	Processed/Cotton	10
Mold	<1		Natural	ND
Pollen	<1		Wood	ND
Diatoms	ND		Paper Pulp	ND
Insect Fragments	ND		Starch	ND
Dust Mites	ND	Synthetic:	(Total)	1
Skin Fragments	<1	Hair:	Human	ND
			Animal	ND
Additional Particulate:	**(%)**			**(%)**
None	N/A	**Unidentified:**	Opaque Particles (B):	5
			Other (C):	70

A: Cellulose is a complex carbohydrate found in nature that is composed of glucose units; it forms the main constituent of the cell wall in most plants. Wood, paper, and cotton all contain cellulose fibers. The cellulose fibers used in clothing items undergo chemical processing that changes the character of the fibers in order to modify water and/or dyes retention.

B: The opaque/dark particles appear to be composed primarily of unidentified organic material and rubber dust. Additional analysis by SEM/EDX and/or FTIR is needed to confirm their identity.

C: The other unidentified material appears to be composed primarily of unidentified material. Additional analysis by SEM/EDX and possibly FTIR is required for confirmation.

Quartz: Crystalline form of silicon dioxide/silica (SiO_2), the second most common mineral in Earth's crust; commonly found in sand/soils, various rocks, concrete, and mortar.

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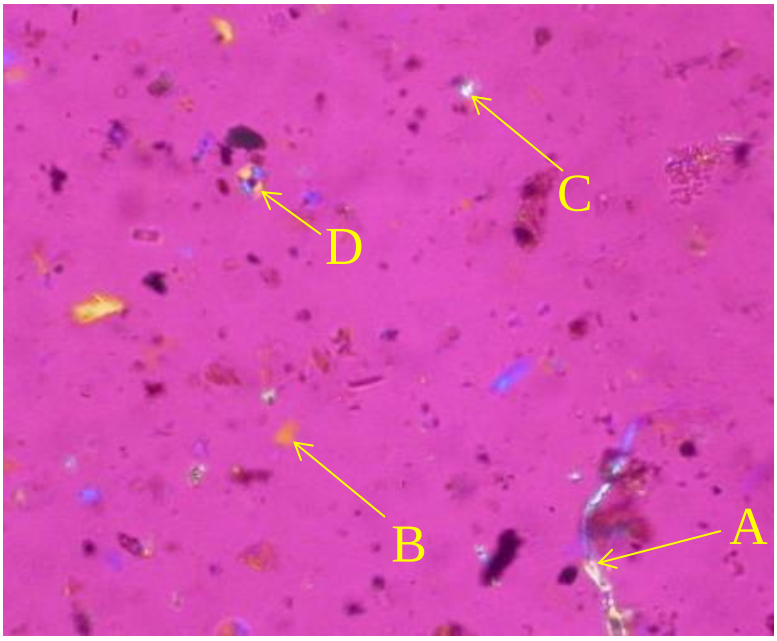
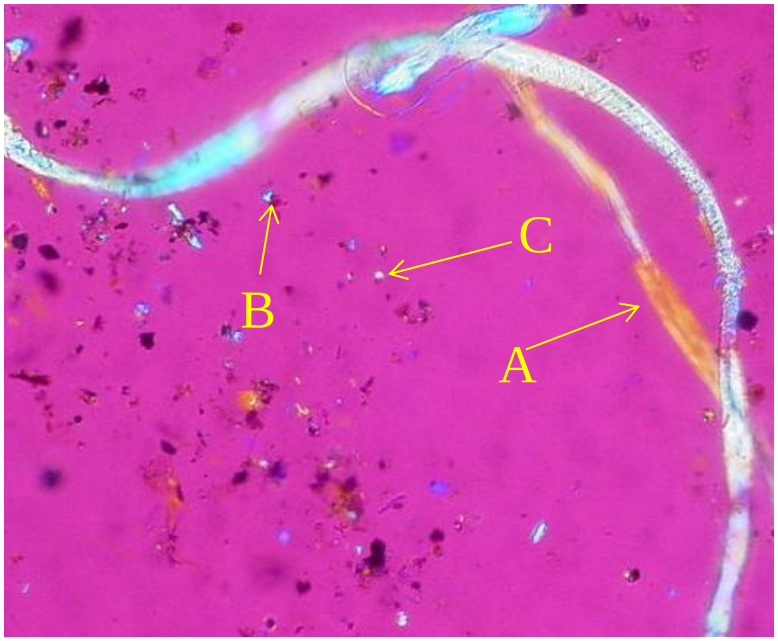


Figure 1: PLM image of the material in sample "C 122-1" (Magnification 200x)
A: Processed Cellulose
B: Quartz
C: Calcite/Dolomite
D: Starch

Figure 2: PLM image of the material in sample "B 110b-1" (Magnification 200x)
A: Processed Cellulose
B: Quartz
C: Calcite/Dolomite



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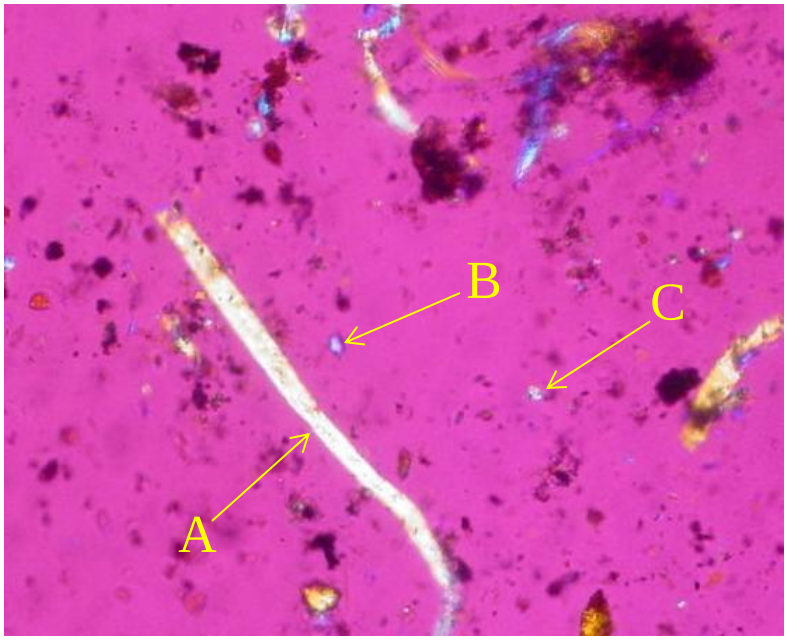


Figure 3: PLM image of the material in sample "B108A-1" (Magnification 200x)
A: Processed Cellulose
B: Quartz
C: Calcite/Dolomite

OrderID: 361500937

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Materials Science Chain of Custody

EMSL Order Number *(Lab Use Only)*: 361500937

EMSL ANALYTICAL, INC
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE. (800) 220-3675
FAX (856) 858-1580

Company: Terracon Consultants, Inc.		**EMSL-Bill to:** ☐ Same ☐ Different If Bill to is Different note Instructions in Comments** *Third Party Billing requires written authorization from third party*	
Street: 3534 Rutherford Rd.			
City: Taylors	**State/Province:** SC	**Zip/Postal Code:** 29687	**Country:** USA
Report To (Name): Ben Hestir		**Fax #:**	
Telephone #: 864-275-9962		**Email Address:** ben.hestir@terracon.com	
Project Name/Number:			
Please Provide Results: ☐ Fax ☑ Email	**Purchase Order:**	**U.S. State Samples Taken In:** SC	

Turnaround Time (TAT) Options – Please Check

☐ 2 Week ☒ Expedited (Please call for information) TAT: 1 week

Test Type

☑ Common Particle ID (large particles)	☐ Combustion-by-products (soot, char, ash, carbon black)	☐ MMVF's (fibrous glass, mineral wool, RCF's)
☐ Full Particle ID (environmental dust)	☐ FTIR/NIR (Polymers, Lubricants)	☐ Particle Size (Sieve, Microscopy, or Laser-select one)
☐ Basic Material ID (solids)	☐ X-Ray Fluorescence (elemental analysis)	☐ Combustible Dust (Core Module, MIE, MEC, Kst, etc)
☐ Advanced Material ID (liquids and solids, industrial residues)	☐ X-Ray Diffraction (Crystalline Particles)	☐ Petrographic Examination of Concrete, Soil, Stone
☐ Physical Testing (Tensile, Compression, etc.)	☐ Other (Please Explain):	

All orders for clients who do not have established accounts with EMSL Analytical must be accompanied by payment in form of a check or credit card. After your first order, EMSL reserves the right to establish an account and assign credit terms of Net 30 or COD based on credit evaluation and or frequency of sample submittal. To establish a permanent account, you must be able to submit samples on a regular basis at a minimum of five times per year. EMSL reserves the right to make adjustments or changes to this policy as deemed necessary by business requirements.

Samplers Name: Ben Hestir **Samplers Signature:** Ben Hestir

	Sample #	Sample Description	Volume	Date/Time Sampled
1	C122-1	Room C122 - top of BBP container	NA - wipe	15:44 May 7, 2015
2	B110b-1	Room B110b - from bookshelf	NA - wipe	15:50 May 7, 2015
3	B108A-1	Room B108A - from behind microscope	NA - wipe	16:10 May 7, 2015

Client Sample # (s): see above **Total # of Samples:** 3

Relinquished (Client): (FedEx pickup) **Date:** 5/8/2015 **Time:** 15:00

Received (Lab): [signature] **Date:** 5/11/15 **Time:** 8:55

Comments: 3xB

Controlled Document – Material Science COC – R3 – 9/22/2011

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Descriptions & Definitions:
None Detected (ND) denotes the absence of analyte in the subsample analyzed. Trace levels of the analyte may be present in the sample below the limit of detection (LOD).

Limit of Detection (LOD): The minimum concentration that can be theoretically achieved for a given analytical procedure in the absence of matrix or sample processing effects. Particle analysis is limited to a single occurrence of an analyte particle in the sub-sample analyzed.

Limit of Quantitation (LOQ): The minimum concentration of an analyte that can be measured within specified limits of precision and accuracy during routine laboratory operating conditions

Trace concentration: denotes the presence of an analyte above LOD but below LOQ. When results are reported as Trace Concentration, at least one particle was detected in the collection of particles that represents the sample.

Concentrations for bulk samples are derived from Visual Area Estimation (VAE) unless otherwise noted. Air sample concentrations are calculated to particles per unit volume.

VAE technique estimates the relative projected area of a certain type of particulate from a mixture of particulate by comparison to data derived from analysis of calibration materials having similar texture and particulate content. Due to bi-dimensional nature of the measurements, in some cases the particle thickness could affect the results.

Important Terms, Conditions, and Limitations:

Sample Retention: Samples analyzed by EMSL will be retained for 60 days after analysis date. Storage beyond this period is available for a fee with written request prior to the initial 30 day period. Samples containing hazardous/toxic substances which require special handling may be returned to the client immediately. EMSL reserves the right to charge a sample disposal or return shipping fee.

Change Orders and Cancellation: All changes in the scope of work or turnaround time requested by the client after sample acceptance must be made in writing and confirmed in writing by EMSL. If requested changes result in a change in cost the client must accept payment responsibility. In the event work is cancelled by a client, EMSL will complete work in progress and invoice for work completed to the point of cancellation notice. EMSL is not responsible for holding times that are exceeded due to such changes.

Warranty: EMSL warrants to its clients that all services provided hereunder shall be performed in accordance with established and recognized analytical testing procedures, when available. The foregoing express warranty is exclusive and is given in lieu of all other warranties, expressed or implied. EMSL disclaims any other warranties, express or implied, including a warranty of fitness for particular purpose and warranty of merchantability.

Limits of Liability: In no event shall EMSL be liable for indirect, special, consequential, or incidental damages, including, but not limited to, damages for loss of profit or goodwill regardless of the negligence (either sole or concurrent) of EMSL and whether EMSL has been informed of the possibility of such damages, arising out of or in connection with EMSL's services thereunder or the delivery, use, reliance upon or interpretation of test results by client or any third party. We accept no legal responsibility for the purposes for which the client uses the test results. EMSL will not be held responsible for the improper selection of sampling devices even if we supply the device to the user. The user of the sampling device has the sole responsibility to select the proper sampler and sampling conditions to insure that a valid sample is taken for analysis. Any resampling performed will be at the sole discretion of EMSL, the cost of which shall be limited to the reasonable value of the original sample delivery group (SDG) samples. In no event shall EMSL be liable to a client or any third party, whether based upon theories of tort, contract or any other legal or equitable theory, in excess of the amount paid to EMSL by client thereunder.

The data and other information contained in this report, as well as any accompanying documents, represent only the samples analyzed. They are reported upon the condition that they are not to be reproduced wholly or in part for advertising or other purposes without the written approval from the laboratory.

Site Photos

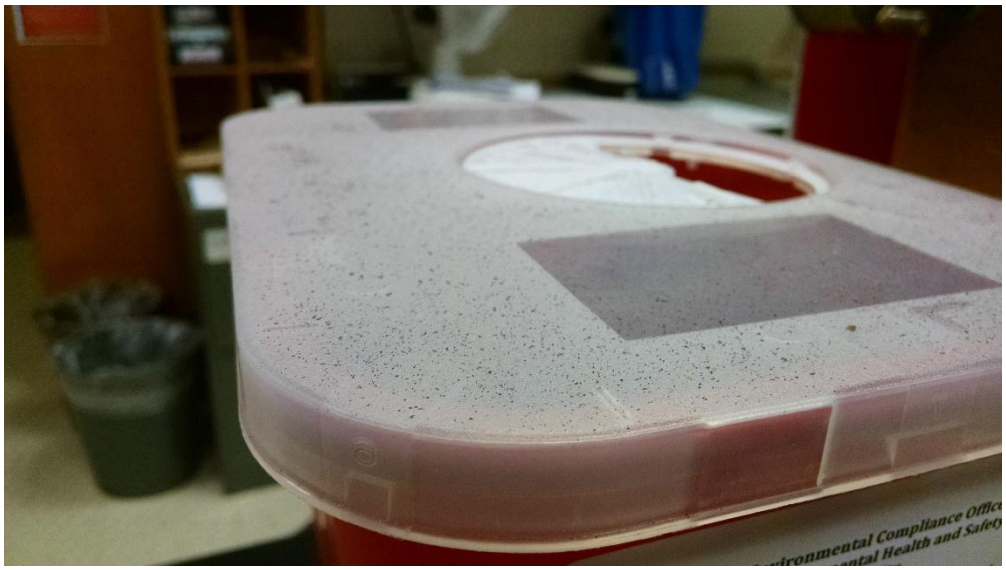


Photo 1 View of particulate accumulation on top of sharps container in room C-122 in the basement of the P&A Building before wipe sample collection



Photo 2 View of particulate accumulation on shelf in Room 110b in the basement level of the P&A Building before wipe sample location

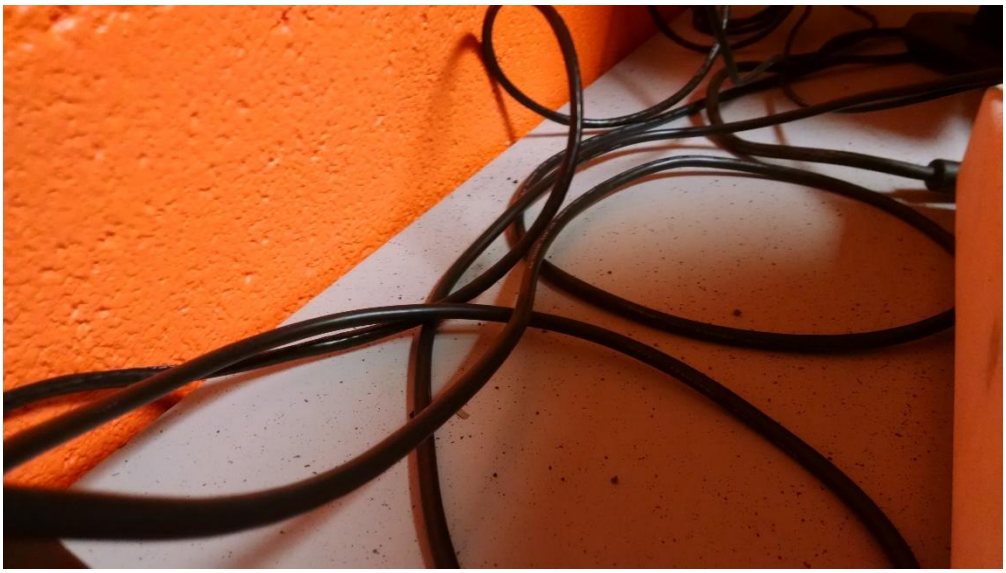


Photo 3 View of particulate accumulation behind microscope in Room 108A before sample collection

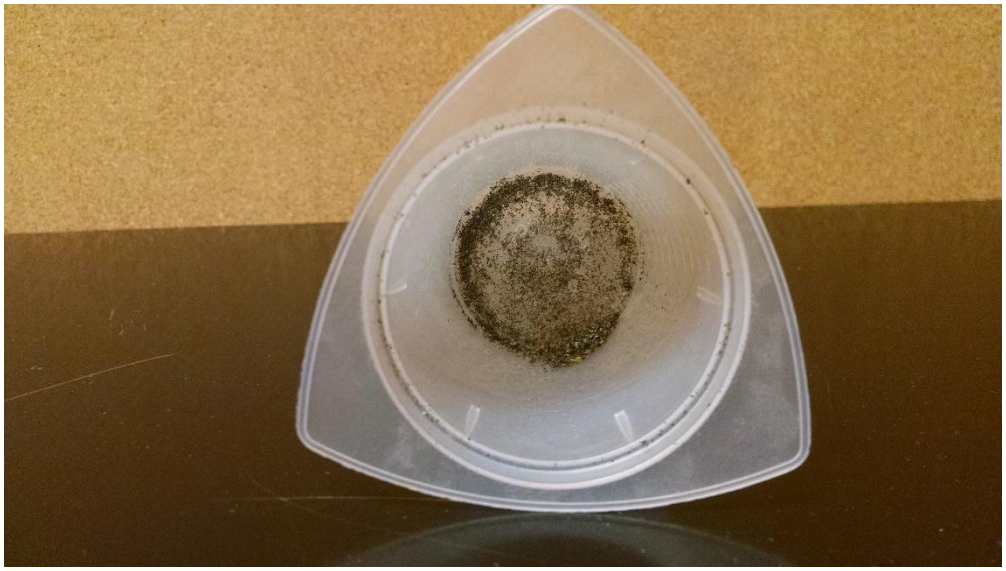


Photo 4 View of dust gathered in lab by Marcy Dimmick in her lab (room B110b)