Respirable Crystalline Silica - Limited Sampling and Risk Assessment

Pierce Hall
University of California - Riverside
Riverside, California

Omega Project #2019-3424UCR
August 20, 2019

Prepared For:

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APPENDICES

1. INTRODUCTION

On August 13, 2019, Kumar Gunaratna, Senior Industrial Hygienist with Omega Environmental Services, Inc. (Omega) conducted a limited sampling assessment at the Pierce Hall, University of California – Riverside (UCR) located in Riverside, California. Ms. Rebecca Lally, Certified Industrial Hygienist with Environmental Health and Safety, UCR (the Client) provided background information and site access for the assessment.

2. EXECUTIVE SUMMARY

According to an Incident Report provided by the Client, on July 5 and 6, 2019, during proposed asbestos abatement activities conducted on the 1st Floor - south hallway, concrete dust was released into areas adjacent to the work areas including faculty offices and laboratories on the south side of the building. Subsequent micro-vac samples were collected from the impacted areas. The laboratory analytical results indicated the presence of silica quartz in the analyzed samples.

The Client retained Omega to collect data and provide a risk evaluation of the possible exposure of respirable crystalline silica (RCS) to the faculty, staff, students and visitors

Omega's study discusses the multiple samples collected during the assessment for RCS, laboratory analytical results and a post remediation/cleanup risk assessment for employees and visitors to the Pierce Hall building (south end) area of impact. Omega also reviewed and analyzed sample results provided by another Consultant to the Client.

Omega's scope of work was limited to the following:

- Document review,
- Conduct limited air sampling for RCS and surface wipe samples for Silica: (Quartz, Cristobalite and Tridymite), and collect direct read measurements for aerosol particulate sizes 3, 5 and 10 micrometers at each air sample location, and
- Develop a written report discussing the findings and the risk assessment.

On critical evaluation of the collected data, relative to the known toxicity values and the regulatory standards for airborne RCS, it is Omega's opinion that the levels of RCS found were not hazardous to the health of any parties entering into or occupying the building. It is also our opinion that residents of the building during or immediately after the abatement were not exposed to any significant health risk resulting from any RCS dust that may have leaked from the abatement containment into adjacent areas.

The Appendices presents Omega Field Notes, Drawing – Sample Locations, Photographs, SGS Galson Laboratory Reports and Chain of Custody and TSI 9306-04 Aerotrak Instrument Calibration Reports.

3. STUDY OBJECTIVES AND PROJECT DESIGN

The overall objective of the study was to evaluate the concentrations of airborne RCS and total non-RCS respirable particles found in and around the impacted areas. In an effort to estimate historic airborne RCS in the building, Omega also collected data on possible depositions of RCS particles throughout the building. Based on this data we would then evaluate potential risk to occupants of the building.

During the subject assessment, Omega collected three types of samples:

- Interior surface wipe samples of settled dust to test for the presence of RSC particles,
- Airborne samples to evaluate airborne RCS inside and outside the building, and
- Real time airborne samples for total respirable particles inside and outside the building.

In addition, Omega reviewed bulk dust sample analytical results collected by Microvac method by another environmental consulting firm.

4. SAMPLING METHODOLOGY

Surface wipe samples (wipes) were collected using 5-micron (u) PVC filter media, rigid sample containers with screw caps, disposable latex gloves (unpowdered) and one-hundred square centimeter (100 cm^2) disposable templates provided by SGS Galson Laboratories[1] (Galson). Wipes were collected on horizontal surfaces where visible dust was noted at the time of the assessment. One set of gloves and a template was used to collect each sample. Omega used a tape measure to note the sample areas where the 100 cm^2 template could not be used. After collecting the sample, the sample media was inserted into a rigid sample container and secured using the screw cap. An unused sample media was included into the surface wipe sample mixture to represent the media batch and for Quality Assurance and Quality Control (QAQC) purposes. Samples were issued unique identifications to represent the sampling locations and documented on a laboratory provided chain of custody (COC).

Area air sampling was conducted by Omega using the media and equipment provided by Galson. SKC cyclones were attached to the pre-weighed 3-piece 37-millimeter (mm) filter cassettes. The samples were mounted on to sampling stands at approximately 4.5 feet height from the floor levels. The samples were connected to sample vacuum pumps calibrated at-site to 2.5 liters per minute. Sampling was conducted at nine (9) separate locations. An unused filter media was included into the sampling mixture to represent the sample media batch and for QAQC purposes.

[1] SGS Galson Laboratory is accredited by the American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program (LAP) and is located at 6601 Kirkville Road in East Syracuse, NY 13057.

The collected air samples were issued unique identifications to represent the sampling locations and documented on a laboratory provided chain of custody (COC). Samples with the COC was delivered to the Galson Offices located at 16 Technology Drive, Suite 132 in Irvine California.

Direct read spot measurements were collected for particulate matter (PM) sizes 3, 5 and 10 microns at each air sample location. Omega used a factory calibrated TSI 9306-04 Aerotrak laser particle counter (LPC) to collect the direct read measurements. The LPC was held at arms-length at a height of approximately five feet (5') from floor level to collect a sample at each location. The LPC was programmed to collect a sixty (60) second measurement. Omega also measured wind speed, wind direction, temperature and relative humidity at the two exterior sample locations. Measurements were scribed onto a field sample data sheet.

5. SAMPLE RESULTS

5.1 Total Airborne Respirable Particulates (Exterior and Interior):

Direct Read - Exterior Aerosol Particulate Measurements

Analyte	Sample Time	PM3 (p/m^3)	PM5 (p/m^3)	PM10 (p/m^3)	Temp 0F	RH %	Wind Speed (f/m)	Comments
Exterior - West	9:25 AM	560,424	208,127	37,456	74	59	6	F/West to East - Towards the building entrance
Exterior - West	12:25 PM	213,428	86,572	14,488	95	26	450	F/West to East - Towards the building entrance
Average - Exterior West of the building:		386,926	147,350	25,972	85	43	228	
Total Sum Particulates- Exterior West:		560,248						
Exterior - East	9:30 AM	518,021	169,965	27,562	74	56	48	F/East to West in courtyard surrounded by 3-story buildings
Exterior - East	12:30 PM	239,929	110,601	23,675	95	26	15	F/West to East - Towards the building entrance
Average - Exterior East of the entrance:		378,975	140,283	25,619	85	41	32	
Total Sum Particulates- Exterior East:		544,877						
Average - Exterior:		382,951	143,816	25,795	85	42	NA	
Average- Total Sum Particulates West & East :		552,562						

PM - particulate matter; p/m^3 - particles per cubic meter; 0F - degrees Fahrenheit; RH - relative humidity as a percent; f/m - feet per minute

Direct Read - Indoor Aerosol Particulate Measurements

Sample Location	Sample Time	Units	PM3	PM5	PM10	Comments
Entrance Lobby - West	9:35 AM	p/M^3	124,382	51,590	8,834	
1st Floor Hallway (South)	9:37 AM	p/M^3	30,389	14,488	2,473	1st floor - foot traffic. Noted during sampling. South hallway ceiling removed. Fire proofing and other services such as HVAC duct, pipes visible in the hallway.
Room 1125	9:41 AM	p/M^3	24,382	9,894	2,120	
Room 1144	9:45 AM	p/M^3	345,583	218,728	60,777	
Room 1127	10:04 AM	p/M^3	24,735	14,488	4,240	
Average - 1st Floor			109,894	61,838	15,689	
Total Sum Particulates - 1st Floor:		187,421				
Room 2125	9:59 AM	p/M^3	97,527	57,597	14,841	2nd Floor - Hallway ceiling intact. Few ceiling tiles were missing or dislodged. No foot traffic noted.
2nd Floor Hallway (South)	10:02 AM	p/M^3	6,714	-	-	
Average - 2nd Floor			52,121	28,799	7,421	
Total Sum Particulates - 2nd Floor:		88,340				
Average - 1 & 2 Floors			81,007	45,318	11,555	
Total Sum Particulates - 1& 2 Floors:		137,880				

PM - particulate matter; p/m^3 - particles per cubic meter;

For total respirable (<10 micron) particles, it was found that the ambient air outside Pierce Hall had an average of 552,562 respirable particles per cubic meter (m^3). The indoor air on the first floor of Pierce Hall had an average of 187,421 particles per m^3. The indoor particle counts for the second floor average 88,340 particles per m^3. The overall respirable particle concentrations inside the building were found to be significantly lower than those found outside the building. The highest indoor sample was from a vacant office on the first floor. Historically most of these respirable non-RSC particles are amorphous sand, solid opaque particles, pollen, fungal spores and other mineral or vegetative particles. These data are common finding in similar studies.

5.2 Air Sampling - Respirable Crystalline Silica (Exterior and Interior):

Galson Laboratory Analytical Results - Respirable Crystalline Silica (RCS), Quartz, Cristobalite and Tridymite

Sample # >		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Sample Location	Units	Ext West	Ext East	1st Flr Lobby	1st Flr So Hall	Rm 1144	Rm 1125	2nd Flr So Hall	Rm 2125	Rm 1227	QAQC/ Batch blank
Lab Result/Quartz	µg	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Lab Result/Cristobalite	µg	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Lab Result/Tridymite	µg	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Lab Result/RCS	µg	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Lab Result/RCS	µg/M^3	< 6	< 7.1	< 6.9	< 6.7	< 6.5	< 6.6	< 6.4	< 6.8	< 6.8	NA
Sample Volume	L	826.50	700.00	726.80	741.00	769.50	758.70	781.20	737.10	734	-
Sample time	M	290.00	280.00	285.00	285.00	285.00	281.00	279.00	273.00	272	-
RCS 8-hr TWA	µg/M^3	< 3.63	< 4.14	< 4.10	< 3.98	< 3.86	< 3.86	< 3.72	< 3.87	< 3.85	-
OSHA - RCS A/L	µg/M^3	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25	25.00
OSHA - RCS PEL	µg/M^3	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50	50.00

µg - micrograms; µg/M^3 - micrograms per cubic meter; L - liter; M - minutes; NA - not applicable
Laboratory analytical method - Modified NIOSH 7500/Modified OSHA ID-142; XRD
Notes: Construction site at the north end of the building. Building occupants have been informed to keep the openable windows closed at all times.

The analytic findings for airborne RCS were at or below the laboratory analytic detection levels. Thus, the results are reported as less than the detection levels for each type of RCS particles (Quartz, Cristobalite, Tridymite).

The airborne RCS studies show that samples taken both inside the building and from outside, ambient air are consistently very low. The outside air averaged less than 7.1 microns/m^3 of RCS. The inside air on the first floor averaged less than 6.7 microns /m^3. The inside air on the second floor averaged less than 6.8 microns/m^3. Thus, based on this sampling there is no evidence of any RCS in the outside or indoor air at the time of sample collection.

5.2 Surface Sampling – Total Crystalline Silica (Interior):

Galson Laboratory Analytical Results - Total Crystalline Silica: Quartz, Cristobalite and Tridymite

Sample #		W1	W2	W3	W4	W5	W6	W7
Sample Location	Units	Rm 1141 - Fixed Windowsill	Rm 1139 - Top of filter/Air Scrubber	1105 - Top of metal cabinet near door	End of Hall @ 1225G - Top of Metal Cabinet	1st Flr East Entry - fixed windowsill (N)	Rm 2134 - Top of metal cabinet	QAQC/ Batch Blank
Sample Area	cm^2	258.00	100.00	100.00	100.00	413.00	100.00	NA
Lab Result/Quartz	mg	0.250	0.270	0.064	0.011	0.110	0.068	< 0.0050
Lab Result/Quartz	mg/cm^2	0.00098	0.00270	0.00064	0.00011	0.00027	0.00068	NA
Lab Result/Cristobalite	mg	< 0.029	< 0.036	< 0.0080	< 0.0050	< 0.018	< 0.012	< 0.0050
Lab Result/Cristobalite	mg/cm^2	< 0.00011	< 0.00036	< 0.000080	< 0.000050	< 0.000044	< 0.00012	NA
Lab Result/Tridymite	mg	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Lab Result/Tridymite	mg/cm^2	< 0.000078	< 0.00020	< 0.00020	< 0.00020	< 0.000048	< 0.00020	NA

cm^2 - square centimeter; mg - milligram; NA - not applicable
Laboratory analytical method - Modified NIOSH 7500/Modified OSHA ID-142; XRD
Windows along the south perimeter building is closed all of the time.
Noted dust and debris on most windowsills.
Rm 1139 - Room air scrubber with HEPA air filter was operational at the time of the sampling. The prefilter located on the top of the scrubber showed heavy dust deposited.

Wipe samples taken inside the building showed only trace levels of Total Crystalline Silica (TCS) at or near the laboratory analytic detection levels. The exception was the surface wipe from a sample of a continuous running HEPA room air filter in a laboratory (Room 1139). This filter was running during the remediation efforts and is thus considered a good indicator of potential airborne RCS. This sample (W2) had 2.7 micrograms (ug) of TCS per square centimeter (cm^2) on its surface. The second highest levels were from a windowsill (W1) at 0.98 ug/cm^2. That window as was determined by the field inspectors to never have been cleaned post remediation. These numbers indicate very low levels at or near the analytic detection limits.

Any RCS detected on surfaces are not airborne and thus do not constitute a health risk. Based on these very low numbers of TCS on surfaces, it is our opinion that even if these instantly all became airborne the immediate concentrations in the air would not constitute a health risk to occupants and would not come close to any airborne safety standards set by regulatory agencies (RCS Action Level 25 ug/m^3 and the Permissible Exposure Limit - operational standard of 50 ug/m^3).

In addition, to the samples taken by Omega Environmental we reviewed the TCS analytic results of three Microvac bulk samples taken by Ambient Environmental Inc., on July 24, 2019. These three samples do not provide information as to the sample locations. They were simply bulk samples collected by a Microvac device and the total bulk analyzed for the presence of TCS particles.

These results indicate only trace levels of **TCS** detected (120-140 ug.) Due to the method used to collect the samples it is impossible to determine area or volumes of collected surface dust. As with the more quantitative Omega samples, these samples show only trace levels of TCS. These TCS particles could have been from multiple sources, such as the trace levels found in the Omega outside ambient air samples. Omega also noted a nearby construction site located just north of the Pierce Hall building.

6. CONCLUSIONS AND RECOMMENDATIONS

Analysis of all the air and wipe samples collected as part of this study show very low (non-detect or at or near the laboratory detection levels) levels of RCS in ambient air or on surfaces, where dust would collect.

Although the total dust levels were high outside the building the total dust levels inside the building were less than one quarter the levels outside of the building. It is suggested that the elevated levels of total respirable dust outside the building are elevated given the geographic location of the campus (semi-arid desert environment) and the on-going construction activities nearby.

All the interior wipe samples all were either non detect or near the laboratory detection levels for TCS. The only two (2) samples with detectable levels for TCS were noted on the wipe samples were (a) on the surface of a HEPA[2] air-filter where the air scrubber had been operational during the abatement activities and (b) on a windowsill that was not cleaned post remediation. The HEPA filter surface sample provides evidence of only trace levels of TCS being generated during the remediation procedure. The levels of TCS detected in wipe samples would not constitute levels that if airborne would generate any human health risk during or post remediation. The windowsill sample results indicate only trace levels of TCS and again suggest only trace levels of RCS were generated during the remediation procedure.

Based on the wipe sample results taken inside the building it can be considered that the total mass of any TCS that even if it was to become airborne would be far less than any health advisory or regulatory concern. (OSHA time weighted exposure levels, TWA 50 ug/m^3 for 40-hour exposure over 40 years or any action levels 25 ug/m^3).

Based on the above findings it is Omega's opinion that there was no significant health risk from RCS to employees, students, or visitors to the building during or post remediation activities.

7. LIMITATIONS

This report and opinions are based on evidence provided by the University of California – Riverside, Environmental Health and Safety officials and the results of the samples collected by Omega Environmental Inc., and Ambient Environmental Inc. If additional information or findings are made available, we reserve the right to change our opinions.

Our services consist of professional opinions, conclusions, and recommendations that are made in accordance with generally accepted consulting standards, principles, and practices. Reasonable attempts have been made to provide a report that is complete and accurate with respect to Omega's authorized scope of investigation. Omega assumes no liability for damages, which might result from errors contained in the report or conditions, which the report fails to disclose.

[2] High Efficiency Particulate Air

APPENDIX 1

OMEGA FIELD NOTES

Field Logs

PROJECT NAME	Pierce Hall (Sciences)	DATE	08/13/19
SITE ADDRESS	UCR, Riverside, CA	Omega PROJECT #	2019-3424UCR
SITE CONTACT	Ms. Rebecca Lally, CIH with UCR	IH NAME	K Gunaratna

630 am
Omega arrived at site – Lot 1 to purchase parking permit (Service). The parking office closed until 7 am. Called Rebecca and met at Lot 24. Rode with Rebecca to Pierce Hall.

700 am
Began calibrating the personal pumps to 2.5 LPM with SKC cyclone attached. After calibrating the pumps checked with Rebecca where the indoor air sample locations would be.

7.35 am
Began area air sampling using the lab provided media (3pc 37mm pre weighed pvc filter cassette) fixed to lab provided SKC cyclones. Sample media/cyclones were attached to sampling stands (tripods) at approximately 4 – 41/2 feet off the finished floor level. Sample locations are identified on floor plans of the Pierce Hall – south side (1st and 2nd floors).

A1 & A2 - Outdoor locations: Outside the west and east entrances.
Indoor samples were collected in the following areas:
A3 - Lobby/waiting area at SW corner,
A4 - 1st floor south hall near Room 1125,
A5 - Room 1144 (Vacant Off),
A6 - Room 1125 (Physics Lab fume hood was operational nearby),
A7 - 2nd floor hallway outside Room 2121,
A8 – 2nd floor Room 2125 (Faculty Lounge), and
A9 - Room 1227 (Office).
A10 - Unused media was included into the sample mix for the batch QAQC.

The sample locations were identified by Rebecca; probably based on the background info she had received from the building Management.

Refer to the area air sampling locations – Drawing

9.25 am
Began collecting spot measurements for PM3, PM5 and PM10 using TSI 9306-04 Aerotrak (SN 93061642012 – Calibration passed on 8/12/19). Refer to Pine Environmental Services, LLC calibration reports.

Temperature, RH and wind speed/direction was noted for the outdoor sample locations. 2 sets of measurements were collected at 9.25 am and 12.25 pm.

10.30 am

Surface wipe samples were collected using the filter media (5-micron pvc filter without the cassette) supplied by the lab. Unpowdered latex gloves and 100 cm^2 disposable sampling templates were also provided by the lab for the sampling. The sampling was conducted using the latex gloves and a template or by measuring the sample area using a measuring tape (in areas where the template would not fit, i.e., windowsill). Samples collected were inserted into lab provided plastic rigid sided containers with screw caps. A set of gloves was disposed as trash after using to collect each sample. Surface sample locations were also identified by Rebecca.

Visible dust and debris were noted on most horizontal surfaces sampled.

Surface wipe sample locations.
W1 - Room 1141/Physics lab: noted dust and debris on the metal windowsill. Sample was collected on this metal surface.
W2 - Also noted a HEPA scrubber operational in Room 1139/Physics Lab located adjacent to 1141 (opened connecting door). The prefilter of the scrubber was completely impacted with dust and debris. Per Rebecca collected sample on the HEPA/Pre filter media.
W3 - Room 1105/Office: Sample was collected on top of a metal cabinet located near the entrance door.
W4 - Hallway outside Room 1225G: Sample was collected on top of a metal cabinet located at the end of the Hallway.
W5 - East lobby/waiting area: Sample was collected on the metal windowsill on north side.
W6 - Sample was collected on top of a metal cabinet located at the NW corner of Room 1234.
W7 - 1 unused wipe filter media was included into the sample mix for the batch QAQC.

Rebecca was advised that a building-occupant meeting had been scheduled for 1.30 pm today. She thought it would better to have the sampling completed and Omega off site before the meeting started.

12.20 pm
Began collecting the air samples. Air and surface samples collected were given unique identification numbers and recorded in a lab provided COC. After noting the post sampling calibration checks, calculating the air sample volumes, Omega was off site at approximately 1.35 pm.

Air Sample Data Sheet

Project Number	2019-3424UCR
Project Site Address	Pierce Hall, University of California - Riverside
Sample Date	8/13/19
Analysis Method	Wipes-Crystalline Silica and area air sampling for Respirable Crystalline Silica
Analysis by	Galson
Date Analyzed	TBD

OMEGA ENVIRONMENTAL

Sample ID: A1-735	Start time: 0735	End time: 1235
Sample location: EXTERIOR - OUTSIDE WEST ENTRY TO SOUTH BUILDING	Flow rate (LPM): 2½ LPM / 3.2 = 2.5	
	Total time: 290	Total volume: 826.5 L
Other comments:		

Sample ID: A2-740	Start time: 0740	End time: 1230
Sample location: EXTERIOR - OUTSIDE EAST ENTRANCE TO SO. BLDG	Flow rate (LPM): 2½ / 2½ = 2½	
	Total time: 280	Total volume: 700 L
Other comments:		

Sample ID: A3-745	Start time: 0745	End time: 1230
Sample location: INT / ENTRANCE LOBBY / WAITING S.W CORNER	Flow rate (LPM): 2½ / 2.6 = 2.55	
	Total time: 285	Total volume: 726.75
Other comments:		

Sample ID: A4-750	Start time: 0750	End time: 1235
Sample location: INT / 1ST FLOOR HALL-SO. NEAR Room 1125	Flow rate (LPM): 2½ / 2.7 = 2.6	
	Total time: 285	Total volume: 741
Other comments:		

Sample ID: ~~S-735~~ A5-753	Start time: ~~0753~~ 0753	End time: 1238
Sample location: ~~Room 1125 EAST END~~ ~~Public Hall Elevators~~	Flow rate (LPM): 2½ / 2.9 = 2.7	
	Total time: 285	Total volume: 769.5
Other comments: Room - 1144 Vacant Room		

Sample ID: ~~S-735~~ A6-755	Start time: ~~0755~~ 0755	End time: 1236
Sample location: ~~Room 1144~~ EAST Vacant Room Lab 1125 EAST	Flow rate (LPM): 2½ / 2.9 = 2.70	
	Total time: 285	Total volume: 758.7
Other comments: Lab Public Hall Elevators EXP		

Sampler name (print)	: K Gunaratna	
Signature	:	Page 1 of _____

Air Sample Data Sheet

Project Number	2019-3424UCR
Project Site Address	Pierce Hall, University of California - Riverside
Sample Date	
Analysis Method	Wipes-Crystalline Silica and area air sampling for Respirable Crystalline Silica
Analysis by	Galson
Date Analyzed	TBD

OMEGA ENVIRONMENTAL

Sample ID: A7-800	Start time: 0800	End time: 12:39
Sample location: 2nd Floor Hallway outside Room 2129	Flow rate (LPM): 2½ / 3.1 = 2.8	
	Total time: 279	Total volume: 781.2
Other comments:		

Sample ID: A8-805	Start time: 0805	End time: 1238
Sample location: 2nd Floor Employee Lounge Room 2125	Flow rate (LPM): 2½ / 2.9 = 2.7	
	Total time: 273	Total volume: 737.1
Other comments:		

Sample ID: A9-810	Start time: 0810	End time: 1242
Sample location: 1ST Floor Office 1227 on 1st Floor	Flow rate (LPM): 2½ / 2.9 = 2.7	
	Total time: 272	Total volume: 734.4
Other comments:		

Sample ID: A10 - QAQC	Start time:	End time:
Sample location: Field Blank	Flow rate (LPM):	
	Total time:	Total volume:
Other comments:		

Sample ID:	Start time:	End time:
Sample location:	Flow rate (LPM):	
	Total time:	Total volume:
Other comments:		

Sample ID:	Start time:	End time:
Sample location:	Flow rate (LPM):	
	Total time:	Total volume:
Other comments:		

Sampler name (print)	: K Gunaratna	
Signature	:	Page 2 of _____

Air Sample Data Sheet

Project Number	2019-3424UCR
Project Site Address	Pierce Hall, University of California - Riverside
Sample Date	
Analysis Method	Wipes-Crystalline Silica and area air sampling for Respirable Crystalline Silica
Analysis by	Galson
Date Analyzed	TBD

OMEGA ENVIRONMENTAL

Sample ID: W1 – 1141	Start time:	End time:
Sample location: Window Sill S. East	~~Flow rate (LPM)~~: Area. 4" x 10" = 258 cm²	
	Total time:	Total volume:
Other comments: Metal Surface		

Sample ID: W2 – ~~1141~~ 1139	Start time:	End time:
Sample location: Filter HEPA air Scrubber	Flow rate ~~(LPM)~~: 100 cm²	
	Total time:	Total volume:
Other comments: Pre filter Surface		

Sample ID: W3 – 1105	Start time:	End time:
Sample location: Top of Metal Cabinet.	~~Flow rate (LPM)~~: 100 cm²	
	Total time:	Total volume:
Other comments: near door		

Sample ID: W4 – Hall/1155	Start time:	End time:
Sample location: Double door metal	~~Flow rate (LPM)~~: 100 cm²	
	Total time:	Total volume:
Other comments: Cabinet top.		

Sample ID: W5 – East Entrance	Start time:	End time:
Sample location: Fixed – A. Window Sill - Metal	~~Flow rate (LPM)~~: 2" x 32" 64 Inch² = 413 cm²	
	Total time:	Total volume:
Other comments:		

Sample ID: W6 – 2134	Start time:	End time:
Sample location: Metal Cab. Top	~~Flow rate (LPM)~~: 100 cm²	
	Total time:	Total volume:
Other comments:		

W7 – B&C

Sampler name (print)	: K Gunaratna	
Signature	:	Page _____ of _____

IAQ - Field Data Sheet

Project Number	2019-3424UCR	IH Name	K Gunaratna
Project Name	Pierce Hall, UCR	Equip/SN	Hygrometer/Extech/1037978 ✓
Project Site Address	UCR, RIVERSIDE, CA	Equip/SN	Air Velocity meter/TSI 5725/T57251517001 ✓
Assessment Date	08/13/19	Equip/SN	Particle Counter/TSI 9306 LPC/SN 1642012

OMEGA ENVIRONMENTAL

Outdoor Measurements: X Indoor Measurements: X

Sample location	Sampling Time	PM_3	PM_5	PM_{10}	Wind Direction	Wind Velocity (f/m)	Temp ^0F	RH %	Comment/s
1 Ext. West @ Sample A1	9.25 AM	560424	208127	37456	W→E	5–6	74	59	In the shade
2 " EAST @ " A2	9.30	518021	169965	27562	E→W	1–48	74	56	SHADE/CT.YARD
3 INT. WAITING AREA (A3)	9.35	124382	51590	8834					
4 " HALL @ A4	9.37	30389	14488	2473					1ST FLOOR
5 " #1125 @ A6	9.41	24382	9894	2120					
6 " #1144 @ A5	9.45	345583	218728	60777					Vacant office
7 " #1225 @ A8	9.59	97527	57597	14841					
8 " HALL @ A7	10.02	6714	0	0					2nd FLOOR
9 " #1127 @ A9	10.04	24735	14488	4240					
10 Ext. West @ Sample A1	12.25 pm	213428	86572	14488	W→E	26–450	95	26	No more shading
11 Ext. East @ Sample A2	12.30pm	239929	110601	23675	E→W	5–15	95	26	— " —
12									
13		Note	Sample A2 - Building courtyard. Buildings (3 Story)						
14			on all 4 - sides. The Wind appeard flow over the						
15	2	story	Pierce Bld, re- direct aff (Bounced aff).						

Notes:
PM_{10} – Particulate Matter less than (<) 10 micrometers (μ); $PM_{2.5}$ – Particulate Matter < 2.5 μ; Mg/M^3 – Milligrams per cubic meter; ppm – Parts per million;
^0F – Temperature in Fahrenheit; RH% - Percent Relative Humidity; f/m – feet per minute

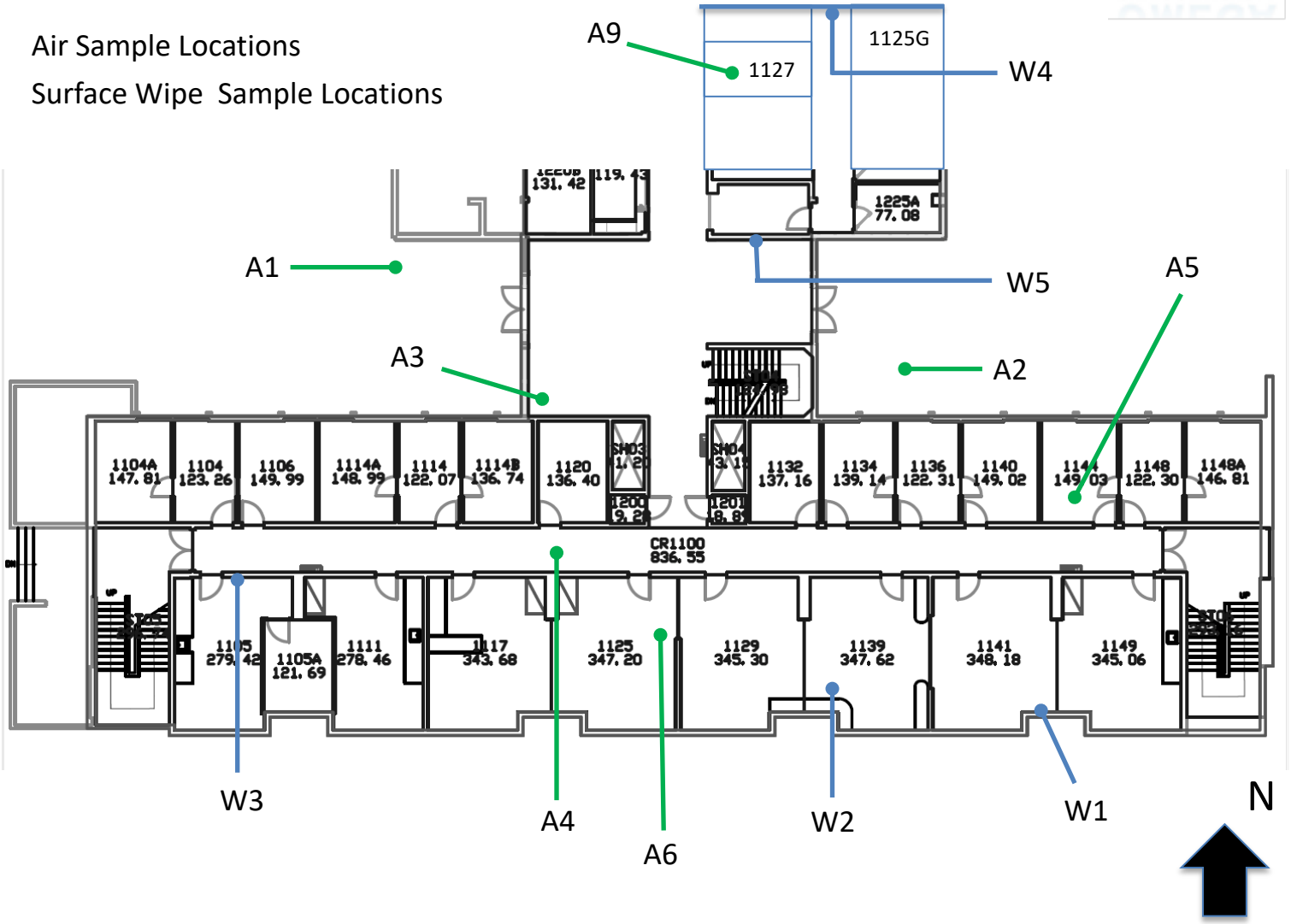
APPENDIX 2

DRAWING – SAMPLE LOCATIONS

Limited Sampling and Risk Assessment
Respirable Crystalline Silica
University of California – Riverside
Pierce Hall
Riverside, California

SAMPLE LOCATIONS
1st Floor

Air Sample Locations
Surface Wipe Sample Locations



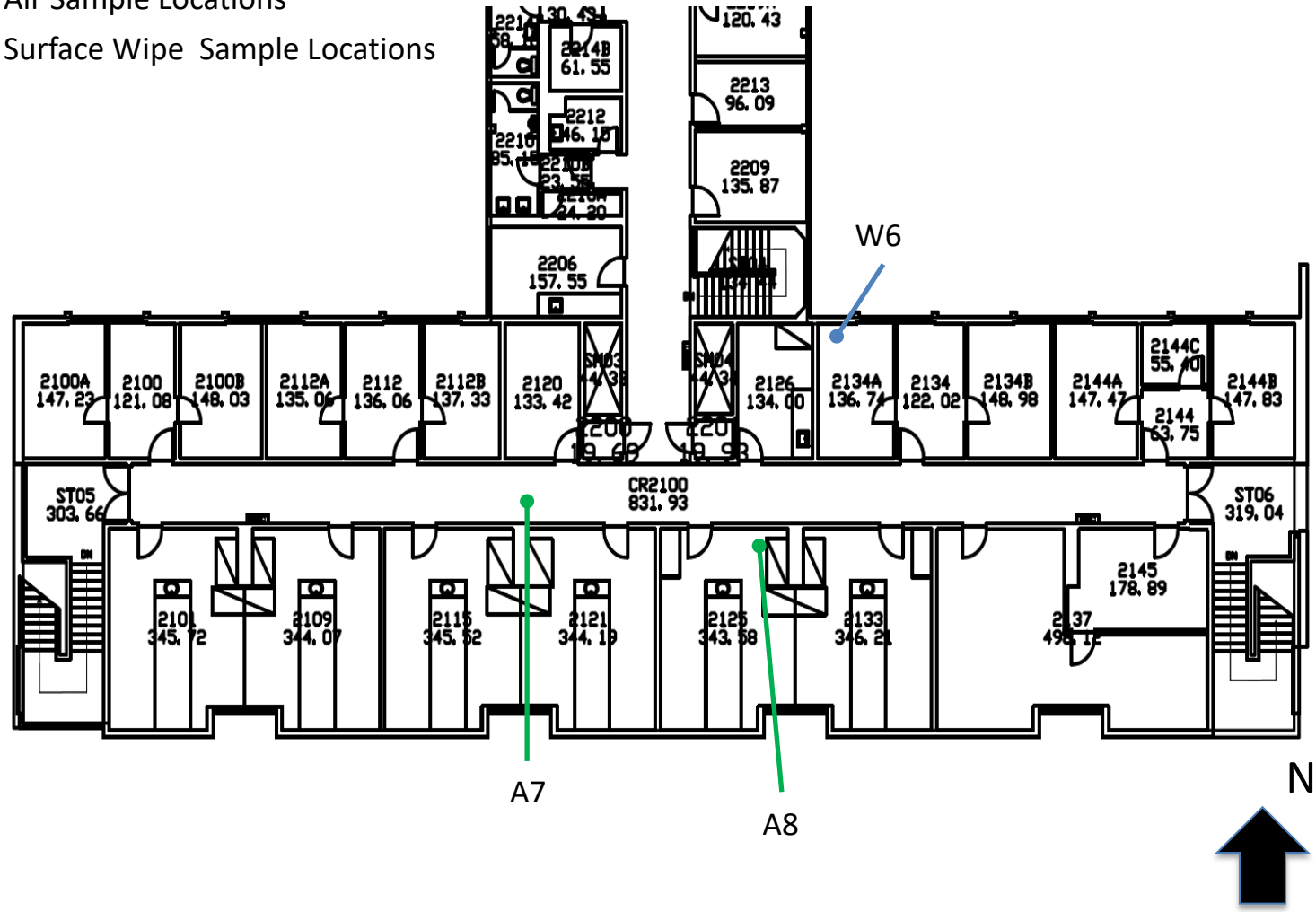
Omega Project #2019-3424UCR
Date – August 20, 2019

Limited Sampling and Risk Assessment
Respirable Crystalline Silica
University of California – Riverside
Pierce Hall
Riverside, California

SAMPLE LOCATIONS
2nd Floor

Air Sample Locations

Surface Wipe Sample Locations



Omega Project #2019-3424UCR
Date – August 20, 2019

APPENDIX 3

PHOTOGRAPHS

Limited Sampling and Risk Assessment
Respirable Crystalline Silica
University of California – Riverside
Pierce Hall
Riverside, California

Photographs

Exterior sample collected outside the South Main Entrance to Pierce Hall.

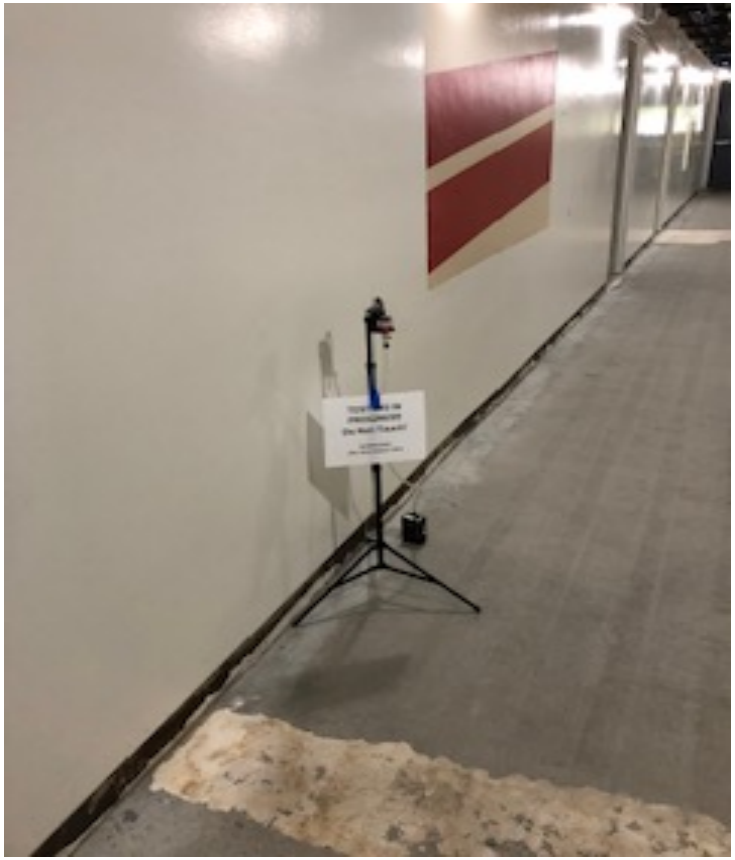
An interior sample collected in a 1st floor laboratory (#1125).

Photographs

Interior wipe sample collected on a metal windowsill in a laboratory (#1141).

An interior surface wipe sample collected on the top surface of a HEPA sir filter located in a laboratory (#1139).

Photographs



Interior air sample location – 1st Floor south hallway where the floor tile and mastic was abated.

Exterior sample location – Direct Read Laser Particle Counter.

APPENDIX 4

SGS GALSON LABORATORY REPORTS AND CHAIN OF CUSTODY

SGS GALSON

Mr. Kumar Gunaratna
Omega Environmental Services
4570 Campus Dr., Ste. 30
Newport Beach, CA 92660

August 15, 2019

Account# 25140

Login# L488904

Dear Kumar Gunaratna:

Enclosed are the analytical results for the samples received by our laboratory on August 14, 2019. All samples on the chain of custody were received in good condition unless otherwise noted. Any additional observations will be noted on the chain of custody.

Please contact client services at (888) 432-5227 if you would like any additional information regarding this report. Thank you for using SGS Galson.

Sincerely,

SGS Galson

Lisa Swab
Laboratory Director

Enclosure(s)

Terms and Conditions & General Disclaimers

- This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.
- Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Analytical Disclaimers

- Unless otherwise noted within the report, all quality control results associated with the samples were within established control limits or did not impact reported results.
- Note: The findings recorded within this report were drawn from analysis of the sample(s) provided to the laboratory by the Client (or a third party acting at the Client's direction). The laboratory does not have control over the sampling process, including but not limited to the use of field equipment and collection media, as well as the sampling duration, collection volume or any other collection parameter used by the Client. The findings herein constitute no warranty of the sample's representativeness of any sampled environment, and strictly relate to the samples as they were presented to the laboratory. For recommended sampling collection parameters, please refer to the Sampling and Analysis Guide at www.sgsgalson.com.
- Unrounded results are carried through the calculations that yield the final result and the final result is rounded to the number of significant figures appropriate to the accuracy of the analytical method. Please note that results appearing in the columns preceding the final result column may have been rounded and therefore, if carried through the calculations, may not yield an identical final result to the one reported.
- The stated LOQs for each analyte represent the demonstrated LOQ concentrations prior to correction for desorption efficiency (if applicable).
- Unless otherwise noted within the report, results have not been blank corrected for any field blank or method blank data.

Accreditations SGS Galson holds a variety of accreditations and recognitions. Our quality management system conforms with the requirements of ISO/IEC 17025. Where applicable, samples may also be analyzed in accordance with the requirements of ELAP, NELAC, or LELAP under one of the state accrediting bodies listed below. Current Scopes of Accreditation can be viewed at http://www.sgsgalson.com in the accreditations section of the "About" page. To determine if the analyte tested falls under our scope of accreditation, please visit our website or call Client Services at (888) 432-5227.

National/International	Accreditation/Recognition	Lab ID#	Program/Sector
AIHA-LAP, LLC - IHLAP, ELLAP, EMLAP	ISO/IEC 17025 and USEPA NLLAP	Lab ID 100324	Industrial Hygiene, Environmental Lead, Environmental Microbiology

State	Accreditation/Recognition	Lab ID#	Program/Sector
New York (NYSDOH)	ELAP and NELAC (TNI)	Lab ID: 11626	Air Analysis, Solid and Hazardous Waste
New Jersey (NJDEP)	NELAC (TNI)	Lab ID: NY024	Air Analysis
Louisiana (LDEQ)	LELAP	Lab ID: 04083	Air Analysis, Solid Chemical Materials
Texas	Texas Dept. of Licensing and Regulation	Lab ID: 1042	Mold Analysis Laboratory license

Legend

< - Less than	mg - Milligrams	MDL - Method Detection Limit	ppb - Parts per Billion
> - Greater than	ug - Micrograms	NA - Not Applicable	ppm - Parts per Million
l - Liters	m3 - Cubic Meters	NS - Not Specified	ppbv - ppb Volume
LOQ - Limit of Quantitation	kg - Kilograms	ND - Not Detected	ppmv - ppm Volume
ft2 - Square Feet	cm2 - Square Centimeters	in2 - Square Inches	ng - Nanograms

SGS GALSON

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FAX: (315) 437-0571
www.sgsgalson.com

LABORATORY ANALYSIS REPORT

Client : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR
Date Sampled : 13-AUG-19
Date Received : 14-AUG-19

Account No.: 25140
Login No. : L488904

Date Analyzed : 14-AUG-19 - 15-AUG-19
Report ID : 1153262

Respirable Crystalline Silica (RCS): Quartz, Cristobalite, Tridymite

Sample ID	Lab ID	Analyte	Air Vol l	ug	ug/m3
A1	L488904-8	Quartz	826.5	<5.0	<6.0
		Cristobalite	826.5	<5.0	<6.0
		Tridymite	826.5	<20	<24
		RCS	826.5	<5.0	<6.0
A2	L488904-9	Quartz	700	<5.0	<7.1
		Cristobalite	700	<5.0	<7.1
		Tridymite	700	<20	<29
		RCS	700	<5.0	<7.1
A3	L488904-10	Quartz	726.8	<5.0	<6.9
		Cristobalite	726.8	<5.0	<6.9
		Tridymite	726.8	<20	<28
		RCS	726.8	<5.0	<6.9

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Level of quantitation: Q:5.0ug C:5.0ug T:20.ug
Analytical Method : mod. NIOSH 7500/mod. OSHA ID-142; XRD
Collection Media : PVC PW 37mm

Submitted by: APG
Date : 15-AUG-19
Supervisor : KRK

Approved by: CMR

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LABORATORY ANALYSIS REPORT

Client : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR
Date Sampled : 13-AUG-19
Date Received : 14-AUG-19

Account No.: 25140
Login No. : L488904

Date Analyzed : 14-AUG-19 - 15-AUG-19
Report ID : 1153262

Respirable Crystalline Silica (RCS): Quartz, Cristobalite, Tridymite

Sample ID	Lab ID	Analyte	Air Vol l	ug	ug/m3
A4	L488904-11	Quartz	741	<5.0	<6.7
		Cristobalite	741	<5.0	<6.7
		Tridymite	741	<20	<27
		RCS	741	<5.0	<6.7
A5	L488904-12	Quartz	769.5	<5.0	<6.5
		Cristobalite	769.5	<5.0	<6.5
		Tridymite	769.5	<20	<26
		RCS	769.5	<5.0	<6.5
A6	L488904-13	Quartz	758.7	<5.0	<6.6
		Cristobalite	758.7	<5.0	<6.6
		Tridymite	758.7	<20	<26
		RCS	758.7	<5.0	<6.6

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Level of quantitation: Q:5.0ug C:5.0ug T:20.ug
Analytical Method : mod. NIOSH 7500/mod. OSHA ID-142; XRD
Collection Media : PVC PW 37mm

Submitted by: APG
Date : 15-AUG-19
Supervisor : KRK

Approved by: CMR

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LABORATORY ANALYSIS REPORT

Client : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR
Date Sampled : 13-AUG-19
Date Received : 14-AUG-19

Account No.: 25140
Login No. : L488904

Date Analyzed : 14-AUG-19 - 15-AUG-19
Report ID : 1153262

Respirable Crystalline Silica (RCS): Quartz, Cristobalite, Tridymite

Sample ID	Lab ID	Analyte	Air Vol l	ug	ug/m3
A7	L488904-14	Quartz	781.2	<5.0	<6.4
		Cristobalite	781.2	<5.0	<6.4
		Tridymite	781.2	<20	<26
		RCS	781.2	<5.0	<6.4
A8	L488904-15	Quartz	737.1	<5.0	<6.8
		Cristobalite	737.1	<5.0	<6.8
		Tridymite	737.1	<20	<27
		RCS	737.1	<5.0	<6.8
A9	L488904-16	Quartz	734.4	<5.0	<6.8
		Cristobalite	734.4	<5.0	<6.8
		Tridymite	734.4	<20	<27
		RCS	734.4	<5.0	<6.8

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Level of quantitation: Q:5.0ug C:5.0ug T:20.ug
Analytical Method : mod. NIOSH 7500/mod. OSHA ID-142; XRD
Collection Media : PVC PW 37mm

Submitted by: APG
Date : 15-AUG-19
Supervisor : KRK

Approved by: CMR

SGS GALSON

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LABORATORY ANALYSIS REPORT

Client : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR
Date Sampled : 13-AUG-19
Date Received : 14-AUG-19

Account No.: 25140
Login No. : L488904

Date Analyzed : 14-AUG-19 - 15-AUG-19
Report ID : 1153262

Respirable Crystalline Silica (RCS): Quartz, Cristobalite, Tridymite

Sample ID	Lab ID	Analyte	Air Vol l	ug	ug/m3
A10-QAQC	L488904-17	Quartz	NA	<5.0	NA
		Cristobalite	NA	<5.0	NA
		Tridymite	NA	<20	NA
		RCS	NA	<5.0	NA

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Level of quantitation: Q:5.0ug C:5.0ug T:20.ug
Analytical Method : mod. NIOSH 7500/mod. OSHA ID-142; XRD
Collection Media : PVC PW 37mm

Submitted by: APG
Date : 15-AUG-19
Supervisor : KRK

Approved by: CMR

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LABORATORY ANALYSIS REPORT

Client : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR
Date Sampled : 13-AUG-19
Date Received : 14-AUG-19

Account No.: 25140
Login No. : L488904

Date Analyzed : 14-AUG-19
Report ID : 1153263

Silica: Quartz, Cristobalite & Tridymite

Sample ID	Lab ID	Area cm2	Quartz mg	Quartz mg/cm2	Cristo mg	Cristo mg/cm2	Tridym mg	Tridym mg/cm2
W1	L488904-1	258	0.25	0.00098	<0.029	<0.00011	<0.020	<0.000078
W2	L488904-2	100	0.27	0.0027	<0.036	<0.00036	<0.020	<0.00020
W3	L488904-3	100	0.064	0.00064	<0.0080	<0.000080	<0.020	<0.00020
W4	L488904-4	100	0.011	0.00011	<0.0050	<0.000050	<0.020	<0.00020
W5	L488904-5	413	0.11	0.00027	<0.018	<0.000044	<0.020	<0.000048
W6	L488904-6	100	0.068	0.00068	<0.012	<0.00012	<0.020	<0.00020
W7-QAQC	L488904-7	NA	<0.0050	NA	<0.0050	NA	<0.020	NA

COMMENTS: Please see attached lab footnote report for any applicable footnotes.

Level of Quantitation: Q:0.0050mg; C:0.0050mg; T:0.020mg
Analytical Method : mod. NIOSH 7500/mod. OSHA ID-142; XRD
Collection Media : PVC Wipe

Submitted by: APG
Date : 15-AUG-19
Supervisor : KRK

Approved by: CMR

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Client Name : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR

Date Sampled : 13-AUG-19 Account No.: 25140
Date Received: 14-AUG-19 Login No. : L488904
Date Analyzed: 14-AUG-19 - 15-AUG-19

L488904 (Report ID: 1153262):
The reported RCS value is based on recoveries of silica polymorphs (Quartz, Cristobalite, and/or Tridymite) greater than the reporting level. The presence of silica below the reporting level cannot be ruled out. When all polymorph results are below the reporting level, RCS defaults to the lowest polymorph concentration. The calibration standard used for Tridymite analysis is not NIST traceable; however, when Tridymite is detected above the reporting level, it is included in the RCS calculation.
SOPs: ix-xrdreview(15), ix-xrdashprep(32), ix-calibrate(13), ix-xrdstdprep(29)

L488904-7-17 (Report ID: 1153262):
Secondary angle was used for Tridymite mass determination.

L488904 (Report ID: 1153262):
Accuracy and mean recovery data presented below is based on a 95% confidence interval (k=2). The estimated accuracy applies to the media, technology, and SOP referenced in this report and does not account for the uncertainty associated with the sampling process. The accuracy is based solely on spike recovery data from internal quality control samples. Where N/A appears below, insufficient data is available to provide statistical accuracy and mean recovery values for the associated analyte.

Parameter	Accuracy	Mean Recovery
Cristobalite	+/-12.9%	94.4%
Quartz	+/-13.5%	90.1%
Tridymite	+/-21.4%	101%

L488904 (Report ID: 1153263):
SOPs: ix-xrdreview(15), ix-xrdashprep(32), ix-calibrate(13), ix-xrdstdprep(29)

L488904-1-3,5-6 (Report ID: 1153263):
Secondary angle was used for Quartz mass determination.

L488904-4,7 (Report ID: 1153263):
Secondary angle was used for Tridymite mass determination.

L488904 (Report ID: 1153263):
We perform a quantitative secondary angle confirmation on all Quartz results greater than 0.025 mg. Secondary angle quantitative confirmation is not possible below 0.025 mg.

L488904-1-3,5-6 (Report ID: 1153263):
Elevated Cristobalite reporting limit due to matrix interference.

L488904-5 (Report ID: 1153263):
During sample preparation for Silica analysis, larger particles in the sample did not break apart to form a uniform deposit. The impact on reported Silica results is unknown.

L488904-1-3,5-6 (Report ID: 1153263):
The Primary Tridymite blank spike recovery was outside the control limits of 72.0% to 121% at 71.0%. Where possible,

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LABORATORY FOOTNOTE REPORT

Client Name : Omega Environmental Services
Site : UCR
Project No. : 2019-3424UCR

Date Sampled : 13-AUG-19 Account No.: 25140
Date Received: 14-AUG-19 Login No. : L488904
Date Analyzed: 14-AUG-19 - 15-AUG-19

L488904-1-3,5-6 (Report ID: 1153263):
control limits are statistically generated in-house. In the absence of statistical limits, guidance default limits of 75
125% are used. The Primary Tridymite blank spike duplicate recovery was within control limits.

1ZX1V0571540118890
Date:08/14/19
Shipper:UPS
Initials:MAK
Prep:UNKNOWN
UN8904

R29

GALSON CHAIN OF CUSTODY

Turn Around Time (TAT):	(surcharge)
☐ Standard	0%
☐ 4 Business Days	35%
☐ 3 Business Days	50%
☐ 2 Business Days	75%
☒ Next Day by 6pm	100%
☐ Next Day by Noon	150%
☐ Same Day	200%

☑ Samples submitted using the FreePumpLoan™ Program

☐ Samples submitted using the FreeSamplingBadges™ Program

You may edit and complete this COC electronically by logging in to your Client Portal account at https://portal.galsonlabs.com/

Client Acct No.: 25140

Original Prep No.: PSY540113

CS Rep: TLANCASTER

Online COC No.: 187440

Report To :	Mr. Kumar Gunaratna
Company Name :	Omega Environmental Services
Address 1 :	4570 Campus Dr., Ste. 30
Address 2 :	
City, State Zip :	Newport Beach, CA 92660
Phone No. :	949 - 252 - 2145
Cell No. :	949 - 230 - 4440
Email reports to :	Kumar@omegaenv.com labreports@omegaenv.com
Email EDD to :	Kumar@omegaenv.com
Comments :	

Invoice To :	Accounts Payable
Company Name :	Omega Environmental Services
Address 1 :	4570 Campus Dr., Ste. 30
Address 2 :	
City, State Zip :	Newport Beach, CA 92660
Phone No. :	949 - 252 - 2145
Email Address :	apdept@omegaenv.com
Comments :	
P.O. No. :	04
Payment info. :	☐ I will call SGS Galson to provide credit card info ☐ Card on File (enter the last five digits on the line below)

Comments : SILICA DUST CLEANUP - POST ASSESS.

State Sampled : CA

Please indicate which OEL(s) this data will be used for :
☐ OSHA PEL ☒ ACGIH TLV ☐ MSHA ☒ Cal OSHA
☐ IAQ : _____ (Specify Limit(s)) ☐ Other : _____ (Specify Other)

Site Name : UCR | Project : 2019-3424UCR | Sampled By : L. Gunaratna | List description of industry or Process/interferences present in sampling area :

Sample ID * (Maximum of 20 Characters)	Date Sampled *	Collection Medium	Sample Volume Sample Time Sample Area *	Liters Minutes in², cm², ft² *	Analysis Requested	Method Reference ^	Hexavalent Chromium Process (e.g., welding, plating, painting, etc.)
W1	8/13/19	5um PVC Filter no Cassette	258	cm^2	SILICA Q CT	NIOSH 7500	Post cleanup
W2	8/13/19	5um PVC Filter no Cassette	100	cm^2	— " —	NIOSH 7500	↓

☐ ^ If the method(s) indicated on the COC are not our routine/preferred method(s), we will substitute our routine/preferred methods. If this is not acceptable, check here to have us contact you.

Chain of Custody	Print Name / Signature	Date	Time		Print Name / Signature	Date	Time
Relinquished By :		8/13/19		Received By :	Vu Nguyen	8/13/19	1445
Relinquished By :	Vu Nguyen	8/13/19	1600	Received By :	Michelle Krause	8/14/19	0813

You must fill in these columns for any samples which you are submitting.

Samples received after 3pm will be considered as next day's business.

Online COC No. : 187440
Prep No. : PSY540113
Account No. : 25140
Draft : 8/2/2019 5:18:40 PM

All services are rendered in accordance with the applicable SGS General Conditions of Service accessible via: http://www.sgs.com/en/Terms-and-Conditions.aspx

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SGS GALSON

CHAIN OF CUSTODY

Comments :

* ID on Sample 104-HALL/1225G, W-2134 SK 8/14/19

Sample ID * (Maximum of 20 Characters)	Date Sampled *	Collection Medium	Sample Volume Sample Time Sample Area *	Liters Minutes in², cm², ft² *	Analysis Requested	Method Reference ^	Hexavalent Chromium Process (e.g., welding, plating, painting, etc.)
W3	8/13/19	5um PVC Filter no Cassette	100	cm^2	SILICA QCT	NIOSH 7500	Post cleanup
* W4		5um PVC Filter no Cassette	100	cm^2		NIOSH 7500	
W5		5um PVC Filter no Cassette	413	cm^2		NIOSH 7500	
* W6		5um PVC Filter no Cassette	100	cm^2		NIOSH 7500	
W7-QAQC		5um PVC Filter no Cassette	—	—		NIOSH 7500	
		5um PVC Filter no Cassette				NIOSH 7500	
		5um PVC Filter no Cassette				NIOSH 7500	
		5um PVC Filter no Cassette				NIOSH 7500	
		3pc 37mm PW PVC			Silica, crystalline quartz, cristobalite, & tridymite (with respirable dust)	mod. NISOH 0600/7500/mod. OSHA ID-142; Grav./XRD	

OK AL 8/14/19

☐ ^ If the method(s) indicated on the COC are not our routine/preferred method(s), we will substitute our routine/preferred methods. If this is not acceptable, check here to have us contact you.

Chain of Custody	Print Name / Signature	Date	Time		Print Name / Signature	Date	Time
Relinquished By :		8/13/19		Received By :	Vu Nguyen	8/13/19	1445
Relinquished By :	Vu Nguyen	8/13/19	1600	Received By :	Michelle Krause	8/14/19	0813

*** You must fill in these columns for any samples which you are submitting..**

Samples received after 3pm will be considered as next day's business.

Online COC No. : 187440
Prep No. : PSY540113
Account No. : 25140
Draft : 8/2/2019 5:18:40 PM

All services are rendered in accordance with the applicable SGS General Conditions of Service accessible via: http://www.sgs.com/en/Terms-and-Conditions.aspx

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SGS GALSON

CHAIN OF CUSTODY

Comments :

(*) ID's have 1-10 incommon only w/COC IDs. SK 8/14/19

Sample ID * (Maximum of 20 Characters)	Date Sampled *	Collection Medium	Sample Volume Sample Time Sample Area *	Liters Minutes in², cm², ft² *	Analysis Requested Respirable Silica	Method Reference ^	Hexavalent Chromium Process (e.g., welding, plating, painting, etc.)
A1	8/13/19	3pc 37mm PW PVC	826.5	Liters	Silica, crystalline quartz, cristobalite, & tridymite ~~(with respirable dust)~~	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	Post Cleanup
A2		3pc 37mm PW PVC	760.0		Silica, crystalline quartz, cristobalite, & tridymite ~~(with respirable dust)~~	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A3		3pc 37mm PW PVC	726.8		Silica, crystalline quartz, cristobalite, & tridymite ~~(with respirable dust)~~	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A4		3pc 37mm PW PVC	741.0		Silica, crystalline quartz, cristobalite, & tridymite ~~(with respirable dust)~~	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A5		3pc 37mm PW PVC	769.5		Silica, crystalline quartz, cristobalite, & tridymite ~~(with respirable dust)~~	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A6		3pc 37mm PW PVC	758.7		Silica, crystalline quartz, cristobalite, & tridymite ~~(with respirable dust)~~	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	

☐ ^ If the method(s) indicated on the COC are not our routine/preferred method(s), we will substitute our routine/preferred methods. If this is not acceptable, check here to have us contact you.

Chain of Custody	Print Name / Signature	Date	Time		Print Name / Signature	Date	Time
Relinquished By :		8/13/19		Received By :	Vu Nguyen	8/13/19	1445
Relinquished By :	Vu Nguyen	8/13/19	1800	Received By :	Michelle Krause	8/14/19	0813

*** You must fill in these columns for any samples which you are submitting.**

Samples received after 3pm will be considered as next day's business.

Online COC No. : 187440
Prep No. : PSY540113
Account No. : 25140
Draft : 8/2/2019 5:18:40 PM

SGS North America, Inc. | 6601 Kirkville Road E. Syracuse, NY 13057, USA t +1 888 432 5227 | +1 315 432 5227 www.galsonlabs.com | www.sgs.com

SGS GALSON

CHAIN OF CUSTODY

Comments :

Sample ID * (Maximum of 20 Characters)	Date Sampled *	Collection Medium	Sample Volume Sample Time Sample Area *	Liters Minutes in², cm², ft² *	Analysis Requested	Method Reference ^	Hexavalent Chromium Process (e.g., welding, plating, painting, etc.)
A7	8/13/19	3pc 37mm PW PVC	781.2	Liters	Silica, crystalline quartz, cristobalite, & tridymite (with respirable dust)	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A8		3pc 37mm PW PVC	737.1		Silica, crystalline quartz, cristobalite, & tridymite (with respirable dust)	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A9		3pc 37mm PW PVC	734.4		Silica, crystalline quartz, cristobalite, & tridymite (with respirable dust)	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	
A10-QABC		3pc 37mm PW PVC	—	0	Silica, crystalline quartz, cristobalite, & tridymite (with respirable dust)	mod. NIOSH ~~0600~~/7500/mod. OSHA ID-142; Grav./XRD	

☐ ^ If the method(s) indicated on the COC are not our routine/preferred method(s), we will substitute our routine/preferred methods. If this is not acceptable, check here to have us contact you.

Chain of Custody	Print Name / Signature	Date	Time		Print Name / Signature	Date	Time
Relinquished By :		8/13/19		Received By :	Vu Nguyen	8/13/19	1445
Relinquished By :	Vu Nguyen	8/13/19	1600	Received By :	Michelle Krause	8/14/19	0813

*** You must fill in these columns for any samples which you are submitting.**

Samples received after 3pm will be considered as next day's business.

Online COC No. : 187440
Prep No. : PSY540113
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APPENDIX 5

TSI 9306-04 AEROTRAK INSTRUMENT CALIBRATION REPORT

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

1340 Reynolds Avenue, Suite 108
Irvine, CA 92614
Toll-free: 888-620-7463

Pine Environmental Services, Inc.

Instrument ID 35974
Description TSI 9306-04 Aerotrak
Calibrated 8/12/2019 11:22:34AM

Manufacturer	Tsi	**State Certified**	
Model Number	9306-04	**Status**	Pass
Serial Number/ Lot Number	93061642012	**Temp °C**	24
Location	California	**Humidity %**	45
Department			

Calibration Specifications

Group # 1
Group Name Zero Test
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration **(As Of Cal Entry Date)**

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Next Cal Date / Last Cal Date/ Expiration Date Opened Date

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Brandon Marley

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

TSI P/N 2300157

CERTIFICATE OF CALIBRATION

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

Environment Condition		
Temperature	73.9 (23.3)	°F (°C)
Relative Humidity	26	%RH
Barometric Pressure	28.95 (980.4)	inHg (hPa)

Model	9306-04
Serial Number	93061642012
Customer Inst ID	

☒ As Left ☐ As Found

☒ In Tolerance ☐ Out of Tolerance

AeroTrak Calibration Kit			
Measurement Variable	System ID	Date Last Calibrated	Calibration Due Date
Flow Meter	E005519	8/28/2018	2/28/2019
7201-02F	E005520	8/15/2018	2/20/2019

Particle Standards				
Particle Size	Standard Uncertainty	Standard Deviation	Lot No.	Expiration Date
0.303 µm	0.003 µm	0.0047 µm	196947	4/30/2021
0.508 µm	0.004 µm	0.0085 µm	185892	6/30/2020
0.994 µm	0.0075 µm	0.010 µm	200992	8/31/2021
2.92 µm	0.015 µm	0.03 µm	181443	2/28/2020
5.020 µm	0.015 µm	0.06 µm	179268	1/31/2020
9.850 µm	0.03 µm	0.13 µm	196944	4/30/2021

TSI does hereby certify that the calibration performed on the above described instrument meets the requirements of ISO 21501-4. TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to the United States National Institute of Standards and Technology (NIST) or has been verified with respect to instrumentation whose accuracy is traceable to NIST, or is derived from accepted values of physical constants. TSI is registered to ISO-9001:2015.

Calibrated

January 28, 2019
Date

TSI P/N 2300157

CERTIFICATE OF CALIBRATION

TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 USA
Tel: 1-800-874-2811 1-651-490-2811 Fax: 1-651-490-3824 http://www.tsi.com

Size Calibration and Verification of Size Setting			
Nominal Particle Size	Gain Stage	Digital Cutpoint	Expanded Uncertainty
0.3 µm	A	30	4.1%
0.5 µm	A	330	3.9%
1 µm	B	6	3.9%
3 µm	B	55	3.7%
5 µm	B	160	3.6%
10 µm	B	525	3.6%

Counting Efficiency			
Particle Size	Actual	Allowable Range	Pass/Fail
0.3 µm	54%	50% ± 20%	Pass
0.5 µm	93%	100% ± 10%	Pass

Size Resolution			
Particle Size	Measured	Allowable Range	Pass/Fail
0.5 µm	4.6%	≤15%	Pass

False Count Rate						
Sample Time (min)	Sampled (L)	Measured Counts (#)	Concentration (#/M^3)	95% UCL (#/M^3)	Allowable Range (#/M^3)	Pass/Fail
30	85	0	0.00	35.3	≤70.7	Pass

Sampling Flow Rate (L/min)				
Nominal	Actual	Error	Allowable Range	Pass/Fail
2.83	2.83	0.0 %	± 5%	Pass

Sampling Time †		
Measured	Allowable Range	Pass/Fail
< ± 0.1%	± 1%	Pass

Response Rate †		
Measured	Allowable Range	Pass/Fail
0.08%	≤ 0.5%	Pass

Maximum Particle Concentration †
210000000 #/m^3 @10% Coincidence Loss

† Tested and verified during product development

Calibration Interval	
Calibration Date	Expiration Date
January 28, 2019	January 28, 2020