February 3, 2016

Mr. Matthew Wemple
Operations Manager
Sofsurfaces, Inc.
4393 Discovery Line
Petrolia, Ontario
N0N 1R0 Canada

Subject: **Dynamic Small-Scale Chamber Emissions Testing**
Laboratory Compliance Report per California Department of Public Health Standard Method Version 1.1 and FloorScore®
Sofsurfaces Recycled Rubber Playground Flooring
MAS Project No.: 1600048

Dear Mr. Voss:

Materials Analytical Services, LLC (MAS) is pleased to submit this report for emissions testing of VOC off-gassing from an application of recycled rubber playground flooring sample submitted in January 2016. This report summarizes our testing procedures and the results of our analytical measurements.

This project was conducted in general accordance with the emission testing guidelines specified under ASTM D 5116. Specific testing parameters and VOC emission limits were based on the California Department of Public Health (CDPH) *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Test Chambers Version 1.1* and FloorScore® testing criteria.

Based on the test results, the Sofsurfaces recycled rubber playground flooring is compliant with the performance standard established for low-emitting flooring under the CDPH and FloorScore® criteria.

MAS is pleased to have been of service to you. If you have any questions or comments, or if we can be of further assistance to you, please do not hesitate to contact us.

Sincerely,

MATERIALS ANALYTICAL SERVICES, LLC

Robert D. Schmitter
Digitally signed by Robert D. Schmitter
DN: cn=Robert D. Schmitter, c=US, o=Materials Analytical Services, LLC, email=bschmitter@mastest.com
Date: 2016.02.03 11:33:35 -05'00'

Manager, Emissions Group

William R. Stapleton
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DN: cn=William R. Stapleton, c=US, o=MAS LLC, ou=Emissions Dept., email=rstapleton@mastest.com
Date: 2016.02.03 12:02:16 -05'00'

Senior Analytical Chemist

Appendices: Appendix A – Chain-of-Custody
Appendix B – General Testing Parameters and Data

MAS LLC - ATLANTA
Corporate Headquarters
3945 Lakefield Court · Suwanee, GA 30024
(770) 866-3200 · Fax (770) 866-3259

ACCREDITED
Testing Cert. #2925.01

COMPLIANCE EMISSIONS TEST

California Dept. of Public Health Standard Method Version 1.1 and FloorScore® Flooring Evaluation

SAMPLE DESCRIPTION & TESTING PARAMETERS

Sofsurfaces, Inc. submitted a flooring exemplar to MAS for emissions testing (refer to photos below). The manufacturer and sample specifics as described in the accompanying chain-of custody (see Appendix A) and a timeline of milestones dates relative to sampling and analysis are summarized below.

Product Name: Recycled Rubber Playground Flooring	**MAS Assigned ID:** 1600048
Manufacturer: Sofsurfaces, Inc. 4393 Discovery Line Petrolia, Ontario N0N 1R0 Canada	**Product Description:** Top/wear layer of virgin rubber; middle and bottom layers of recycled rubber Approx. 12” x 12” x 5” as submitted
Manufacture Date: Jan. 4, 2016	**Testing Period:** Jan. 15 – 29, 2016
Collection Date: Jan. 4, 2016	**In-Chamber Sampling Dates:** Jan. 26 @ 24 hrs.; Jan. 27 @ 48 hrs.; Jan. 29 @ 96 hrs.
Shipping Date: Jan. 6, 2016	**Date of Sample Analysis:** Feb. 1 – 2, 2016
Laboratory Arrival Date: Jan. 11, 2016	**Age of Sample at Testing:** 11 days

Sofsurfaces Recycled Rubber Playground Flooring as received (left) and tested (right)

SAMPLE HANDLING & EMISSIONS TESTING

To prepare the sample for chamber testing, the rubber support columns were removed and the sample was cut from its original size to a size of 6 inches x 6 inches and placed on a stainless steel tray. The sample was taped to the tray using a non-emitting aluminum tape with an approximate one-quarter inch overlap of tape onto the sample. The sample was then placed inside one of MAS’s small-scale (53 liter) stainless steel emissions chambers on the chamber floor beneath a fan to facilitate even air circulation around the sample.

Emissions from the sample were collected and analyzed in general accordance with ASTM D5116 *Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products*. Sample conditioning, collection of samples, and analysis of compounds of interest were conducted in accordance with the California Department of Public Health (CDPH) *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1*, and the FloorScore® criteria for flooring. General testing parameters and data are presented in Appendix B.

TESTING RESULTS

In order to compare the chamber derived data to the standards established under CDPH Standard Method Version 1.1 and the FloorScore® criteria for low emitting materials an emission factor for the tested sample is calculated based on the 96 hour data following ten days of in-chamber conditioning. This emission factor is then applied to the defined parameters of that product in a typical school classroom and private office environment accounting for the specified room sizes and ventilation rates.

CDPH modeling parameters define a typical classroom as having a total floor area of 89.2 square meters, and a typical private office as having a total floor area of 11.15 square meters. For purposes of this report, a typical application was assumed to be the entire floor area. The results of the modeling data are presented in Table I.

Table I
Emission Factors and Predicted 96-Hour Airborne Concentrations for the Sofsurfaces Playground Flooring in Typical Building Environments

VOC Name	Calculated Emission Factor (µg/m²hr)	Predicted Airborne Concentration (µg/m³)		Maximum Concentration Limits (µg/m³)	Testing Comment
	96th hour (4 days)	Classroom*	Private Office**		
Total VOCs (TVOC)	1100	540	600	NA	NA
Formaldehyde[1,2]	4.5	2.2	2.4	9	Compliant
Acetaldehyde[1,2]	6.6	3.2	3.6	70	Compliant
Isopropanol	<2.9	<1.4	<1.6	3500	Compliant
1,1-dichloroethylene	<2.9	<1.4	<1.6	35	Compliant
Methylene chloride[2]	<2.9	<1.4	<1.6	200	Compliant
Carbon disulfide[1,2]	<2.9	<1.4	<1.6	400	Compliant
MTBE[2]	<2.9	<1.4	<1.6	4000	Compliant
Vinyl acetate[2]	<2.9	<1.4	<1.6	100	Compliant
Hexane[2]	<2.9	<1.4	<1.6	3500	Compliant
Chloroform[1,2]	<2.9	<1.4	<1.6	150	Compliant
2-methoxyethanol[1]	<2.9	<1.4	<1.6	30	Compliant
1,1,1-trichloroethane[2]	<2.9	<1.4	<1.6	500	Compliant
Benzene[1,2]	<2.9	<1.4	<1.6	1.5	Compliant‡
1-methoxy-2-propanol	<2.9	<1.4	<1.6	3500	Compliant
Carbon tetrachloride[1,2]	<2.9	<1.4	<1.6	20	Compliant

1,4-dioxane[1,2]	<2.9	<1.4	<1.6	1500	Compliant
Trichloroethylene[1,2]	<2.9	<1.4	<1.6	300	Compliant
Epichlorohydrin[1,2]	<1.5	<0.72	<0.81	1.5	Compliant
2-ethoxyethanol[1]	<2.9	<1.4	<1.6	35	Compliant
n,n-dimethylformamide[2]	3.0	1.6	1.6	40	Compliant
Toluene[1,2]	3.0	1.6	1.6	150	Compliant
2-methoxyethanol acetate[1]	<2.9	<1.4	<1.6	45	Compliant
Tetrachloroethylene[1,2]	4.4	2.1	2.4	17.5	Compliant
Chlorobenzene[2]	<2.9	<1.4	<1.6	500	Compliant
Ethylbenzene[1,2]	<2.9	<1.4	<1.6	1000	Compliant
m & p-xylene[2]	6.0	2.9	3.2	350	Compliant
Styrene[2]	4.1	2.0	2.2	450	Compliant
o-xylene[2]	<2.9	<1.4	<1.6	350	Compliant
Phenol[2]	5.7	2.7	3.1	100	Compliant
1,4-dichlorobenzene[1,2]	<2.9	<1.4	<1.6	400	Compliant
Isophorone[2]	<2.9	<1.4	<1.6	1000	Compliant
Naphthalene[1,2]	4.2	2.0	2.3	4.5	Compliant

* Assumes a classroom size of 24’ x 40’ x 8.5’ with a ventilation rate of 0.82 h^{-1} as defined by CDPH/EHLB/Standard Method V.1.1
** Assumes a private office size of 10’ x 12’ x 9’ with a ventilation rate of 0.68 h^{-1} as defined by CDPH/EHLB/Standard Method V.1.1
‡ No benzene was detected in the sample; however, modeling criteria elevates the predicted concentration above the minimum limit set by CDPH. MAS believes the compound is compliant with CDPH criteria.
1 – Chemical compound also listed on Cal/EPA OEHHA Safe Drinking Water and Toxic Enforcement Act of 1986 (Prop 65) list
2 – Chemical compound also listed on Cal /EPA ARB list of Toxic Air Contaminants (TACs)

CONCLUSIONS

Based on the emissions test data, MAS offers the following findings and conclusions:

- Predicted airborne concentrations of CDPH target compounds at the 14-day test point in both a classroom and private office setting are compliant with the maximum concentration limits established by the California Department of Public Health and FloorScore® criteria for flooring materials.

LIMITATIONS

This report is intended for the use of Sofsurfaces, Inc. and SCS Global Services only. If other parties wish to rely on this report, please have them contact us so that a mutual understanding and agreement of the terms and conditions for our services can be established prior to their use of this information. This report shall not be reproduced, except in full, without the written approval of Materials Analytical Services, LLC.

Emissions generally decay over time, and the representativeness of the analytical data reported is directly dependent upon the age and conditions under which the tested sample was received.

APPENDIX A

Chain-of-Custody

1600048

Materials Analytical Services LLC
3945 Lakefield Court
Suwanee, Georgia 30024
Phone: 770-866-3200
Fax: 770-866-3259

Emission Testing
Chain-of-Custody

Client Information
Company: Sofsurfaces Inc.
Street Address: 4393 Discovery Line
City/State: Petrolia, Ontario
Zip/Postal Code: N0N 1R0
Country: Canada
Contact Name: Matthew Wemple
Title: Operations Manager
Phone Number: (800) 263-2363 ext. 222
Fax Number: (519) 882-2697
Email Address: wemplem@sofsurfaces.com

Testing Specifications (per MAS) check appropriate test below
▫ **R&D (custom):** Specify Details
▫ **24-hour Comparative R&D Test**
▫ **72-hour Comparative R&D Test**
X 14-day FloorScore / CDPH Compliance Test

Manufacturer Information (if different than client)
Company:
City/State/Country:
Contact Name/Title:
Phone Number:

Construction Details (as applicable)
Flooring
Describe Top/Wear Layer: Virgin Rubber
Describe Middle & Bottom Layer(s): Recycled Rubber
Describe Undelayment:N/A
Adhesives
Identify type: Acrylic ▫, SBR Latex ▫, Urethane/Moisture Cured x, Pressure Sensitive ▫, Epoxy ▫, WaterBased ▫, Powder ▫, Floating Glues ▫, Cement ▫

Sample Details
Unique Sample ID (if applicable):
Product Name & Catalog #: Recycled Rubber Playground Flooring
Product Type: Hardwood Flooring ▫, Laminate Flooring ▫, V/C Tile ▫, Rubber Flooring **x**, Vinyl Sheet ▫, Baseboard Molding ▫, Stair Treads/Risers ▫, Adhesives ▫, Underlayments ▫, Other ▫ Specify:
Date of Product Manufacturing Completion: 1/4/2016
Collection Location: Factor Line **X**, Warehouse ▫, Production Stack/Roll ▫, Retail Package/ Container ▫
Sample Submitted by: Matthew Wemple
Date of Sample Shipment : 1/6/2016
Number of Boxes or Pallets: 1

Special Notes or Comments from Manufacturer:
Please send a copy of the results to Ellen Hendrickson (ehendrickson@scsglobalservices.com) at SCS Global Services.

Shipping Details
Packed By:Marty Swan on 1/5/2016
Shipping Date: 1/6/2016
Carrier/Airbill Number: 1Z05E84X6841685358

Laboratory Receipt (to be completed by Laboratory Representative)	
Received By:	W Thorne
Received Date:	1-11-16
Condition of Shipping Package:	OK
Condition of Sample:	OK
Remarks:	

Sample Handling

Relinquished By	Company	Received By	Company	Date/Time
		W Thorne	MAS	1-11-16/10:10

SCANNED

Shipping Package Inspected By:
1. WT Date 1-11-16
2. MS Date 1-11-16

APPENDIX B

GENERAL TESTING PARAMETERS AND DATA

Under the provisions of the testing method referenced in this report, testing consisted of the following procedural steps:

- Specific procedures for specimen receiving, handling, and preparation.
- Storage of test specimens in original shipping containers prior to emissions testing for up to 10 days in a ventilated and conditioned room maintained at a temperature of 23 ± 2°C and a relative humidity of 50% ± 15%.
- For quality assurance purposes the emission chamber was purged and the interior thoroughly cleaned prior to all new product tests. Air samples were collected and analyzed from the chamber exhaust prior to loading to establish background levels.
- Collection of air samples at method-specified intervals from the chamber exhaust port utilizing mass flow controllers calibrated at 180 cc/min for VOCs and at 150 cc/min for aldehydes.
- Tenax TA® tubes (drawn in duplicate) are used for VOC analysis which is performed by thermal desorption gas chromatography/mass spectrometry (TD-GC/MS) using a modified EPA TO-17 method. Samples are also collected on DNPH tubes for aldehyde analysis which is performed using high performance liquid chromatography (HPLC) using a modified NIOSH 2016 method. All samples are collected in duplicate and analyzed separately.
- Instrument calibration, analysis of quality control samples and quantitation of the CDPH target list of 35 chemicals of concern.
- Reporting and speciation of top 10 tentatively identified compounds.

The operational parameters for the small emission chamber utilized for this project included:

Parameter	Value	Parameter	Value
Chamber Volume	0.053 m^3	Area Specific Flow Rate	2.356 m/h
Loading Factor	0.425 m^2/m^3	Temperature	23 $\pm$ 1 ºC
Air Exchange Rate	1.0 $\pm$ 0.05 h^{-1}	Relative Humidity	50 $\pm$ 5%

The emissions testing protocol was designed to measure the release of volatile organic compounds from a given material over time. The results of the emissions testing are summarized in the tables presented on the following pages.

Total volatile organic compounds (TVOC) are defined as the compounds eluting between hexane (*n*-C_5) and hexadecane (*n*-C_{17}) and in this protocol quantified as toluene *(note that there are no specific TVOC limits specified under CDPH)*. The measured concentration of total volatile organic compounds (TVOC) obtained at each of the three sampling intervals is presented in Table B-I.

Table B-I
Total Volatile Organic Compounds (TVOC) between n-C_5 and n-C_{17} Measured by GC/MS*

Sample Interval (hours)	TVOC Concentration (µg/m³)	TVOC Emission Factor (µg/m² h)
24	490	1100
48	650	1500
96	480	1100

*TVOC values are background corrected

The measured concentrations of formaldehyde and acetaldehyde obtained at each of the three sampling intervals are presented in Table B-II.

Table B-II
Formaldehyde and Acetaldehyde Concentrations as Measured by HPLC

Sample Interval hours	Target Compound	Concentration (µg/m³)	Emission Factor (µg/m² h)
24	Formaldehyde	<1.4	<3.2
48	Formaldehyde	2.5	5.9
96	Formaldehyde	1.9	4.5
24	Acetaldehyde	1.8	4.3
48	Acetaldehyde	1.8	4.3
96	Acetaldehyde	2.8	6.6

Individual volatile organic compounds (IVOC) were identified by GC/MS after 96 hours of off-gassing from the sample. These are presented in Table B-III.

Table B-III
Speciation of all Tentatively Identified IVOCs* by GC/MS after 96 hours

CAS Number	Tentatively Identified Compounds	Library Match Percent	Concent. (µg/m³)	Emission Factor (mg/m² h)	Match Quality
95-16-9	benzothiazole	NA	47	110	Confirmed
41902-42-5	3-pentanol, 3-(1,1-dimethylethyl)-2,2,4,4-tetramethyl-	37	26	62	Poor
110-03-2	2,5-hexanediol, 2,5-dimethyl-	78	33	79	Poor
1070-83-3	butanoic acid, 3,3-dimethyl-	47	13	32	Poor
108-94-1	cyclohexanone	93	16	39	Good
108-10-1	MIBK	NA	11	26	Confirmed
541-02-6	cyclopentasiloxane, decamethyl-	81	11	27	Poor
4030-18-6	pyrrolidine, 1-acetyl-	9	15	36	Poor

112-40-3	dodecane	NA	14	34	Confirmed
	1-butanol, 2,2-dimethyl-	53	4.0	9.5	Poor

*All IVOCs detected were identified using the average response factor of toluene calibration standards. Match qualities of less than **85%** are not considered to be proof of chemical identity per EPA protocols.

The Library Match Percent is a comparison of mass spectra by the library search algorithm of the Chemstation G1701DA mass spectrometry software package with the Wiley and NBS 75K mass spectral database. The search methods that we use apply a "match quality" to the search result, based upon a scale of 100%. MAS tentatively identifies compounds with a minimal match quality of $\geq$ 85%. The sum concentration of the IVOC's does not necessarily correlate with the TVOC concentration under the analytical conditions.